A new teaching strategy for hearing impaired pupils in Iraq: Aspects of mathematics and science for pupils aged 9-14 years.

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A NEW TEACHING STRATEGY FOR HEARING IMPAIRED PUPILS IN IRAQ

"ASPECTS OF MATHEMATICS AND SCIENCE FOR PUPILS AGED 9-14 YEARS"

submitted by Nadia-Shaában Mustafa

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Mustafa

In memory of my Father and to my Mother,
who guided my steps through life.

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ABSTRACT

The study is concerned with the development of a teaching strategy suited to the specific needs of hearing impaired children. It was conducted in the last three grades in primary special schools for hearing impaired children in Baghdad.

The teaching method was based around worksheets and materials in a resource-based learning context to enhance pupil understanding in the subject areas of mathematics and general science.

The learning materials and the teaching method were used in one special school for hearing impaired as a pilot trial. The pupils and their teachers confirmed that the materials and method were easy to follow; knowledge and, unexpectedly, spoken and written language improved.

For the field trial a language test was developed and validated. The six schools in the field trial were divided into two groups: experimental and control. The new teaching strategy was used with the experimental group; the control group, however, remained with the old method by using the same content of mathematics and science. Within these two groups there were matching grades, as well as matching pairs in the three grades to facilitate the statistical comparison between the pre- and post-tests,

The methods for collecting information before, during and after the course were: pre- and post-tests (language and content), which were used with both groups. Observation, record cards and interviews with teachers and pupils were used with the experimental group. Some individuals in the control groups were observed (matched pairs).

The pupils in the experimental group showed a marked improvement after only six weeks in their knowledge, as well as in their language tests. However, the control group neither improve their language nor their knowledge in mathematics.

The new teaching method and materials improved the pupils' performance in the experimental group.

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CHAPTER ONE : INTRODUCTION

CHAPTER 1

INTRODUCTION

1. The Problem

"Hearing impaired" pupils are those whose development of speech and language, although retarded,are following a normal pattern and who require special arrangements or facilities for their education.

Schools for hearing impaired children are under the Ministry of Labour and Social Affairs, not the Ministry of Education.

Teaching methods used with hearing impaired pupils in Iraq are similar to those used with pupils who hear normally. The teacher teaches the whole class by explaining some examples from a normal text-book, sometimes using the blackboard. The pupils have no textbooks and copy work into their notebooks. The teacher also gives the pupils homework and the following day she marks their notebooks. Regardless of the difficulties experienced by the pupils, the teacher progresses to the next unit according to plan. The teacher works in this way with the pupils in every subject.

The present study aims to offer something suited to the particular needs of hearing impaired pupils by developing different teaching methods based around worksheets and materials in a resource-based learning context. It also aims to facilitate understanding in the subject areas of Mathematics and General Science, as well as the development of language, for this special type of pupils.

The idea to produce these materials for hearing impaired pupils came after visiting the following schools and realising that many of the ideas and techniques used could be applicable to the situation in Iraq:-

1) South Twerton Junior School (Partial Hearing Unit), Bath.
2) The Ralph Allen School (Partial Hearing Unit), Bath.
3) Longvernal County Primary School, Midsomer Norton.
4) Beechen Cliff Lower School, Bath.

Learning for the hearing impaired must be thought of as the restructuring of the cognitive world without normal verbal, symbolic language (Neyhus, 1978). Thinking can take place without language, while verbal reasoning cannot. Language is important, not only as a means of communication, but also because it is central to aspects of a child's development. In the process of remembering, one of the chief effects of language is to foster accuracy of recall. It is obvious that the simple way to learn the language is to hear it spoken in meaningful situations and to practice it. Teaching methods, therefore, have to be different for hearing impaired pupils.

The development of concepts in a hearing impaired child needs to be associated with language. Most hearing impaired children can, for example, follow a lesson, but in order fully to understand a lesson, one must have language. Without language, the child does not have the necessary means to express what is known.

Many researchers have considered the value of visual and tactual methods and some of these appear to be of potential value for pupils. The use of supplementary sensory methods could be valuable, and are emphasised in this study.

There is no language test available in Arabic to test children's language, therefore a language test (both spoken and written) was developed, validated and used to test the subject's language in the field study.

Resource-based learning is not used in schools in Iraq. Hence, appropriate learning materials such as worksheets were produced as part of the present study, in order to complement new teaching strategies for the hearing impaired and to encourage them to think, talk and discuss, read and write.

The present study is limited to the development and application of new strategies for learning into two subject areas, Mathematics and General Science, at the primary school stage for the hearing impaired in Baghdad, Iraq. These particular teaching units were chosen for development in an attempt to put ideas into practice.

(a) Learning of Mathematics: Fractions Unit (for 3 grades, Fourth, Fifth and Sixth)

This unit was chosen because it was totally neglected by teachers in hearing impaired schools, according to information given to the investigator by the Centre of the Hearing Impaired, although it is in the prescribed curriculum. The investigator felt it was necessary to carry out some work in this field.

(b) Learning of General Science: the Plants Unit (for the Fourth and Fifth Grades) Magnetism Unit (for the Sixth Grade)

The Plants Unit was chosen because of the great emphasis placed by the Iraqi Government on directing a bigger section of society towards agricultural activities and to emphasise this in all primary schools in Iraq. The magnetism unit was chosen because of the potential for practical work and teaching aids leading to the development of psycho-motor skills in children.

Attainment tests were administered to test the pupils' understanding of the three units (Fractions, Plants and Magnetism).

In order to ascertain that the new method has improved the pupils' language in general and the understanding of the specific areas in Mathematics and General Science, the schools were divided into two groups, "Experimental" and "Control". Each group consisted of 63 pupils. Eleven teachers were involved in the experimental group and twelve in the control group. The new methods and techniques were used to gather information for the experimental group. However, the control group continued to use the old method,

Figure 1 illustrates the methods used with the experimental and control groups.

The aids used in the development of the resource-based learning materials were developed using a comparison between Iraq and the UK.

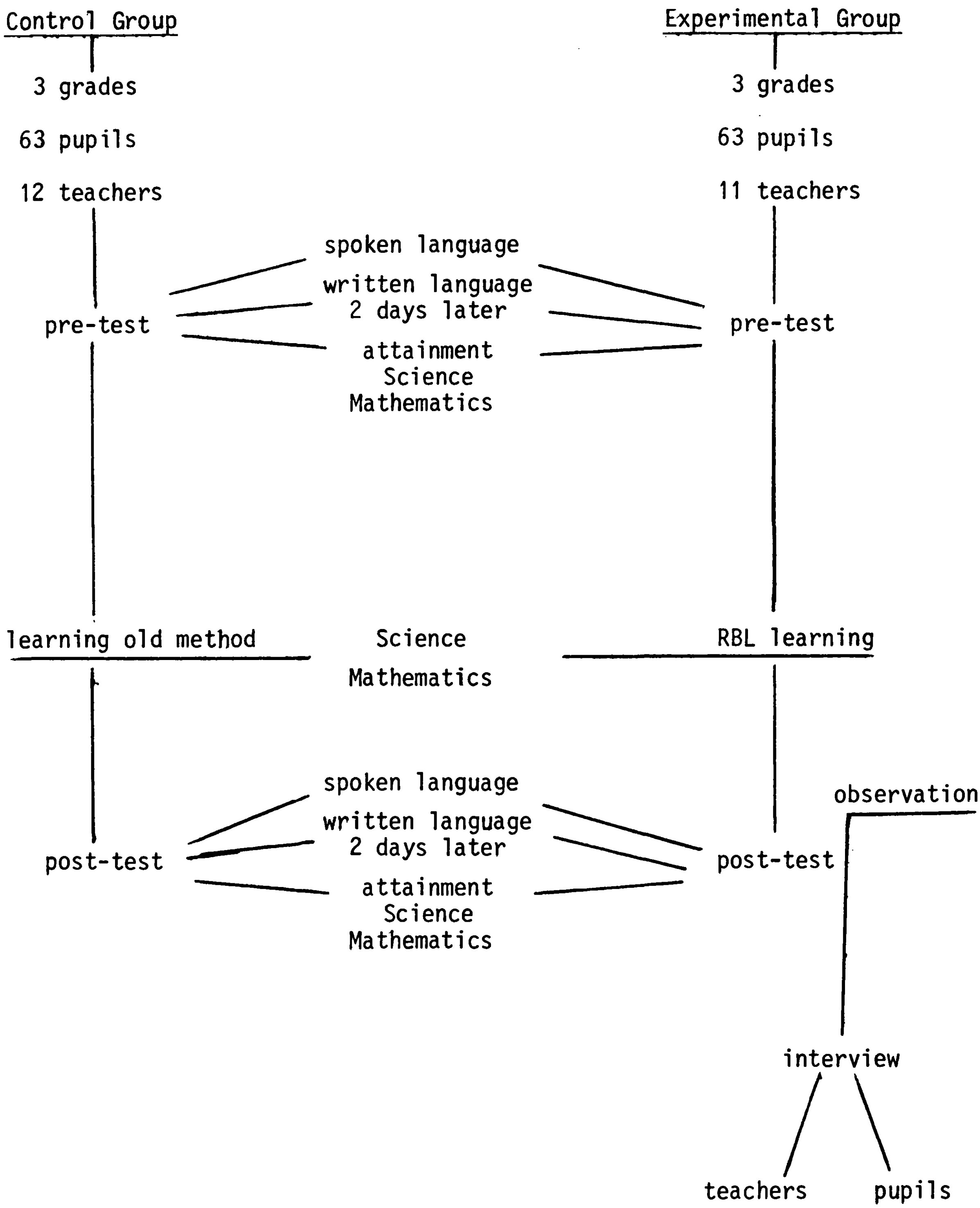


Figure 1 The methods used with the Control and Experimental Groups

2. Comparison between Iraq and the United Kingdom

In order to help identify criteria on which a comparative study could be based, the investigator visited Iraq twice during the study; first in December, 1982 to January, 1983 and second, from March to May, 1983. There appears to be no available documentation concerning the education of hearing impaired children in Iraq. All the author's investigations with the Ministry of Labour and Social Affairs, the Ministry of Education, the Centre of Hearing Impaired Children and UNESCO revealed nothing. For this reason, the Director of the Hearing Impaired Centre, the Inspectors of hearing impaired schools and the Director of Vocational Training were interviewed to gather some information.

Even in the UK, the literature on education for the hearing-impaired is not extensive. However, the Department of Audiology and Education of the Deaf at the University of Manchester and the Faculty of Education at Bristol Polytechnic were visited, as well as some schools (see page 2). It was clear that the following topics could be chosen as the basis for comparison:

(i) Identification of handicaps (the definition and classification of hearing loss and hearing tests).

(ii) Teaching methods for hearing impaired pupils.

(iii) Training of teachers for hearing impaired pupils.

(i) Identification of Handicaps - the definition and classification of hearing loss in Iraq and the United Kingdom

There are two major approaches to the definition and classification of hearing loss, which are used in Iraq as well as in the United Kingdom:

- degree or severity of loss
- physiological site of loss

- Classification according to severity The range of human hearing extends from 1-130 dB, when the dB is a measure of loudness sounds louder than 130 dB are experienced by the normal ear as painful. Figure 2 shows a continuum of loudness of common sounds and levels of hearing loss from mild to total.

The first three categories along the continuum include the partially hearing; the last two categories on the continuum comprise the deaf.

(1) Mild (slight) hearing loss:

Children with mild impairments cannot hear sounds below about 30 dB (Suran and Rizzo, 1979). However, different researchers use somewhat different ranges to define mild hearing loss. Thus Silverman (1971) mentions that mild hearing loss refers to a sound-frequency loss range between 21-40 dB, and the Illinois Commission on Children (1968) mentions that the mild hearing loss refers to losses of 27-40 dB. This is the borderline range between normal hearing and genuine impairment. A hearing aid is often advisable for children with losses in this range, and professional intervention may be important in maintaining good speech patterns, since mildly hearing-impaired youngsters may not hear some consonant sounds that are typically spoken at slightly diminished volume. However, the age of onset and type of impairment influence the choice of intervention strategies.

(2) Moderate hearing loss:

Children with moderate hearing loss cannot hear sounds below 50 dB (Suran and Rizzo, 1979). However, Silverman (1971) and the Illinois

	Level of hearing loss	dB	Sounds unable to be heard
		odB	
Partially Deaf	mild	10, 20, 30	a whisper
Partially Deaf	moderate	40, 50	normal house sound an electric typewriter
Partially Deaf	severe	60, 70, 80	ordinary conversation
Deaf	profound	90, 100	street traffic, telephone ring
Deaf	total	110, 120, 130	loud thunder, rock and roll band, motorcycle engine

Figure 2 Examples of the sound pressure levels (dB) of typical sounds and levels of hearing loss

Commission on Children (1968) define moderate hearing loss in the range 41-55 dB.

With full visual advantage, these children understand conversational speech at a distance of 3-5 feet (Illinois Commission on Children, 1968). But Silverman (1971) claims that the child can process normal conversational speech at a distance of up to about 6 feet. Therefore, amplification with a hearing aid is needed if such youngsters are to learn adequate receptive and expressive language. These frequently used terms refer simply to the ability to understand (receptive language) and to speak (expressive language) (Suran and Rizzo, 1979). Depending on the age of onset, language development and speech may be affected. Problems with articulation, reading, vocabulary, and attention are likely to occur (Silverman, 1971).

(3) Severe hearing loss

Children with severe hearing loss cannot hear sounds less than 80 dB (Suran and Rizzo, 1979). However, Silverman (1971) and the Illinois Commission on Children (1968) state that the severe hearing loss is in the range 56-70 dB. Children with this degree of disability are unable to develop adequate receptive or expressive language without professional intervention, because they simply cannot hear ordinary spoken language. Even with intervention which includes amplification, audio training and speech therapy, speech patterns are likely to be quite unusual, because amplification cannot replicate ordinary conversational sounds (Suran and Rizzo, 1979).

(4) Profound hearing loss

Children with profound hearing loss cannot hear sounds below 100 dB (Suran and Rizzo, 1979). Silverman (1971) and the Illinois Commission on Children (1968) give a range for this category of 71-90 dB. Children with profound hearing loss, even with amplification, cannot hear ordinary language sounds accurately. Intervention by a special educator for the deaf is essential to minimise the handicapping consequences of profound impairment.

(5) Total hearing loss

Children with total hearing loss, a condition known technically as anacusis, cannot hear anything more than noise-type sensations. Intervention is critical if totally deaf children are to develop any receptive or expressive language in the form of manual sign, finger spelling, speech reading or writing (Suran and Rizzo, 1979).

- Classification according to site of loss The second major method of classifying hearing impairments is based on identification of the anatomical site responsible for interference in normal auditory functioning. The two systems (classification according to severity and classification according to site of loss), together provide a comprehensive description on the nature of the impairment. Classification according to site of loss falls basically into four types: (1) conductive; (2) sensorineural; (3) mixed; and (4) central auditory.

(1) Conductive hearing loss

Children with conductive hearing loss experience interference in the transmission of sounds from the auditory canal to the inner ear. A purely conductive hearing impairment usually involves malfunction of the tiny bones of the middle ear, but does not involve any damage to the inner ear or cerebral cortex. In many cases, conductive hearing loss can be medically treated or surgically corrected.

(2) Sensorineural hearing loss

Sensorineural hearing loss is the result of damage to the inner ear and its associated sensory cells and nerve pathways. Sensorineural hearing losses may be congenital or acquired, and are caused by maternal infections, anaxia, genetic defects, and prolonged to high intensity noise (Kirk and Gallagher, 1979). Hearing loss due to sensorineural damage usually cannot be corrected medically.

(3) Mixed hearing loss

In some children, hearing loss may be a consequence of impairment in the conduction of sounds and of sensorineural damage. It is temporary, because the conductive hearing loss is usually treatable, medically or surgically.

(4) Central hearing loss

Central hearing loss may be more appropriately referred to as dysfunction, because it involves subtle neurological damage in the cerebral cortex, which interferes with the perception, organisation and comprehension of the sounds, rather than a loss in the ability to hear sounds (Suran and Rizzo, 1979).

Testing the Hearing of Young Children in Iraq and the UK

- Testing the hearing of young children in Iraq There are no screening tests for young children in Iraq. But if parents are aware of a hearing problem, then they contact a special school, The condition of admission is that the family has to offer the school evidence that their child suffers from a handicap. They explain the kind of handicap he or she suffers and the school then refers their request to the Centre for the Welfare of the Handicapped. This Centre refers the child to the Centre of Diagnosis of Handicaps (hearing impairment) to make tests of hearing called Diagnostic Tests, which are undertaken usually at a specialist Audiology Clinic. The same two diagnostic tests which are used in the UK (which will be explained later) are used in Iraq, but not at the same age. There is a speech test of hearing which consists of some pictures with which the child is usually familiar. This test is applied to children who come to the Centre of Diagnosis of Handicaps (hearing impairment), regardless of the child's age and language level. After the degree and nature of hearing loss for the child are obtained, this Centre refers the child to the Audiology Centre to select a suitable hearing aid.

In addition to the hearing tests, IQ and social adjustment are tested for the child. The Social Research Department visits the family of the pupil and then provides the school with a file for each pupil which contains all the relevant information.

Afterwards, these children attend the special schools because of their impairment and they need special teaching.

- Testing the hearing of young children in the UK Two categories of hearing test are used in the assessment of young children. The first category is known as screening tests. Thus the first test is usually carried out by health visitors in local Health Centres or Child Health Clinics at around six to nine months of age. The aim of this type of test is to identify children with abnormal hearing. This is a pass/fail test and if hearing loss seems to be established, no estimate is made of its level.

The second category of tests is known as diagnostic tests. These tests are undertaken usually at a specialist audiology clinic, following failure of the screening test. The clinic may be centred on the Ear, Nose and Throat Department of a hospital, in an area child health clinic, or a regional specialist audiology clinic. At this test, specialists will be present and the aim will be to define the level of loss and also the nature of the loss (see Appendix I for more details of the two categories).

Comparison of the Two Countries and Summary

In Iraq, there is no early diagnosis for hearing impaired children, which delays the early use of hearing aids, therefore, there is no auditory training until school age. At this age, the children need more time to master their language and development and interpretation of language.

In the UK, there are different hearing tests for children of different ages. In all areas, parents are encouraged to attend local child Health Clinics for routine checks on their child's development in the early years.

Hearing impaired children will have to be based not only on an assessment of hearing loss, but also on language achievement or potential. The Reynell Developmental Language Scale is commonly used in the UK to assess the level of the child's understanding of spoken language and his ability to express himself verbally. The test, which has both comprehension and expression scales, has receptive and expressive vocabulary tests (Nolan and Tucker, 1981). This test is used as an indication of the child's educational placement.

The implication from the above is that in Iraq, hearing impaired children in grades one and two learn the pronunciation of letters and words with an oral examination only in the third grade. This study, therefore, is restricted to grades four, five and six. In the UK, however, there are many ways in which the hearing impaired are integrated into the regular school, as well as teaching methods used with them. This is because of the early diagnosis, the use of hearing aids and auditory training.

(ii) Teaching Methods for Hearing Impaired Pupils in Iraq and the UK -

- Teaching Methods for Hearing Impaired Pupils in Iraq

There is only one teaching method for teaching hearing impaired pupils in Iraq, as the investigator discovered. All children are taught using a didactic approach. The teacher uses the same textbook as in ordinary schools. There is no resource based approach (see page 1 for further details).

- Teaching Methods for Hearing Impaired Pupils in the UK

There is not just one teaching method for teaching hearing impaired pupils in the UK, whether the pupils are in special school units or in regular classes. Each teacher has his/her own method for teaching them. For example:

(a) South Twerton Junior School (Partial Hearing Unit 'PHU'), Bath

This unit receives pupils of junior school age living within the Bath area who need this specialist teaching. The pupils study the full range of subjects which are typical of current junior stage curriculum subjects in this country.

The method of teaching the pupils in Mathematics is that the teacher uses special books for Mathematics in the beginning, then uses the textbooks which are used in normal classes and the pupils have exercise books. The teacher does not use the same book with all the pupils, but adopts an individual method to teach them. A practical method is used to explain the subject and the pupils also use this method. There is no timetable, but the teacher endeavours to give them the same information.

There is no subject called Science, but there is a subject called Topic work, which includes History, Geography and Science. The teacher explains this subject by using the television programme "Watch", or by means of a story. The teacher then discusses this programme or the story with them as a class, which is followed by practical work such as drawing, painting or collage work.

Pupils in the unit then usually transfer at secondary stage to Ralph Allen School, Bath, where the specialist teaching is continued.

(b) Ralph Allen School, Bath (Partial Hearing Unit 'PHU')

The PHU's role is to support pupils who suffer a hearing loss which is not severe enough to require placement in a school for the deaf, yet too much of a handicap for them to go unaided through an ordinary school.

Pupils in the first year come to the PHU during English, French and Mathematics lessons. They receive tuition appropriate to their individual needs in language and numerical work and when necessary, extra help with other subjects in the curriculum. In this latter area, the excellent support and co-operation from members of staff are invaluable. After the first year, some pupils may rejoin classes in Mathematics or English in the main school, but some time is still

The Unit is well stocked with reading material to give extra practice in a skill in which hearing-impaired pupils often under-achieve. The teacher in the unit works with the pupils individually or as a group.

(c) Longvernal County Primary School, Midsomer Norton

This school admits normal and handicapped pupils within an age range of 5 to 11 years (Infant and Junior School). The building may be described as modified open-plan. The pupils, for the most part, are grouped in classes according to age. Each class is kept as small as possible. Pupils are sometimes taught as a class. Within the class, there is individual work and group work organised both by ability and interest. Each class is taught by its class teacher for all subjects, except when a teacher's special skills can be put to good use by co-operative teaching. Class, groups and individual teaching carried out in a well-disciplined, but generally informal setting.

Within the staffing allocation of the school, pupils having particular difficulties, such as hearing impaired children, are withdrawn from the class and given extra tuition in the basic subjects. A visiting specialist teacher may also be involved in this.

Every group has a different book in language and Mathematics. For those who have difficulty in these two subjects, like hearing impaired children, the teacher works with them using worksheets and extra practical work with discussion. Homework is not normally set. There is no formal timetable. Every pupil has a record card.

Comparison between the Two Countries

In Iraq, all the teachers follow the same method for teaching the hearing impaired in all subjects. The pupils in this method are passive to learn subjects and language. Thus, because there is no training for teachers, a new teacher asks an experienced teacher how to teach the pupils and so on. Any improvement in teaching methods have to be introduced by the Ministry of Labour and Social Affairs, not the Ministry of Education.

Classes for the hearing impaired are small, usually containing between 8 to 12 children. All these classes are supplied with group hearing aids, as well as one hearing aid per child (see Photograph 1).

Photograph No.1

In the UK, there are several teaching methods for teaching hearing impaired children. Each teacher has his own method, but it is a method which helps the pupils to learn the subjects, as well as the language, because the pupils are keen to learn. This is dependent on training the teachers as teachers of hearing impaired children, which allows them to deal with the situation better.

Classes for the hearing impaired are small in the UK, as mentioned above in Iraq. However, the children have different types of hearing aids from one school to another. For example, in South Twerton Junior School, the hearing impaired have a Radio Transmission System as a type of hearing aid.

As a conclusion to the literature on education for the hearing impaired and the visits to some schools in the UK, it was felt that the method which was used in Iraq was inadequate. Therefore, the present study was undertaken to develop a new method of teaching the hearing impaired, taking into consideration their special needs in learning the language and understanding the subjects. The new resource-based method uses work sheets, individual learning, group learning and discussion combined with practical work.

(iii) Training of Teachers for the Hearing Impaired in Iraq and the UK -

- Training of Teachers for the Hearing Impaired in Iraq

Hearing impaired children are educated in special schools, serving age groups from 6 to 15 years (primary school). The teachers for these schools are graduates from different places, including Universities, Institutes and Teachers Institutes. Sometimes, teachers are trained for only 7 to 10 days or less, within their work context.

- Training of Teachers for the Hearing Impaired in the UK

Hearing impaired children are sometimes educated in special schools, day or boarding, or units, serving any or all age groups from nursery to 16 or 19 years. There are secondary grammar, comprehensive, secondary, technical and various schools which provide further education.

Handicapped pupils, in whatever type of school, need teachers with specialist qualifications in addition to those required for teaching children with normal hearing.

In summary, there are three methods of qualifying teachers in the UK:

(a) In-service training for teachers already qualified

The British Association of Teachers of the Deaf awards a Diploma on the results of an external examination after a period of part-time study. This examination, which is approved by the Department of Education and Science, may be taken after a minimum of 18 months and a maximum of three years' service as a full-time teacher in a recognised school for the deaf or partially-hearing children or a partially-hearing unit.

(b) Full-time courses for qualified teachers wishing to train as teachers of hearing impaired children

A one-year, full-time course of training is offered in the Department of Audiology and Education of the Deaf, University of Manchester, University of Newcastle-upon-Tyne, Oxford Polytechnic / The Lady Spencer-Churchill College, Hertfordshire College of Higher Education and the Scottish Centre for the Education of the Deaf.

(c) A four-years undergraduate course

A four years undergraduate course leading to the degree of BA and recognition as a qualified teacher of the deaf has recently been provided by the Department of Audiology and Education of the Deaf at the University of Manchester.

(d) Advanced courses for teachers already holding the qualification to teach the deaf

Teachers with experience may be admitted to the advanced one year courses of study at the University of Manchester leading to an MEd or Diploma in Audiology and the MEd or Diploma in Advanced Education of the Deaf. However, the course for the Diploma in the Advanced Study of

Education of the Deaf and Partially Hearing Children will extend over one academic year (full-time), or two academic years (part-time).

Comparison between the Two Countries

In Iraq there is no specialised training of teachers. Sometimes teachers are trained for only 7 to 10 days or less within their work. However, in the UK, there are different courses of teachers' training for the hearing impaired.

The conclusion from this study is that there is a possibility for training teachers in Iraq to use a new teaching strategy.

CHAPTER TWO : A NEW TEACHING STRATEGY

A NEW TEACHING STRATEGY

1. Introduction

For adequate direction and guidance in science, educators have often turned to the works and theories of developmental psychologists such as Piaget, Bruner and Gagné. Frequently, science and mathematics curricula change and innovations are motivated by new discoveries or theories in the field of child development. As shown by the work of Stern (1953) and others (advocating the use of structural materials for number work) and that of Dienes, whose Multi-base Arithmetic Blocks, Algebraic Experience material, Logic Blocks (and more recently other 'concrete' materials) are described and explained in a range of books resulting from his experimental teaching (Dienes, 1960). This work was followed by the development of a series of texts for the psychology and mathematics project by Skemp, 1964-8. A mathematician turned psychologist, Skemp was one of the first to attempt to bring the principles of educational psychology to bear explicitly on the problems of teaching mathematics. Skemp (1971) attempted a detailed conceptual analysis of the inter-relation between mathematical topics. The Nuffield primary science and mathematics project was also built upon the foundation of the above works (Watson, 1976). The theories of Piaget, Bruner and Gagné and the views of other educators have had a tremendous impact on the science and mathematics curricula. These theories give some indication as to what should be taught, how it should be taught and the sequence of teaching (International Congress on Mathematical Education, 2nd, Exeter, 1972). Equally important is the impact of these theories on the development of the textbooks, content and teaching strategies recommended in method, books, and materials on the teaching of science and mathematics in the primary schools (Watson, 1976).

2. Teaching Strategy

As previously mentioned in Chapter 1, in Iraq, the teaching methods for teaching hearing impaired pupils is less than satisfactory. Teaching methods for children without hearing impairment are based on the various theories of Piaget and others, but it is maintained that these should be developed according to the needs of hearing impaired children.

In a reappraisal of Piaget, Duckworth (1964, p.173) has stated that 'good pedagogy must involve presenting the child with the situation in which he himself experiments, in the broadest sense of that term, trying things to see what happens, manipulating things, manipulating symbols, posing questions and seeking his/her own answers, reconciling what he finds at one time with what he finds at another, comparing his findings with those of other children'. Thus, one of the important goals of science and mathematics education should be to create opportunities for children to invent and discover. Such ideas with regard to learning do not belong only to Piaget. Bruner (1968) and Dewey (1916) each advocated the pupil's right to learn in as individualised a manner as possible. In addition, Lawson and Renner (1978) found that elementary school pupils and junior high pupils can be helped to move from the concrete operational stage towards and into the formal operational stage by the use of enquiry-centred experiences in science. Also, Cusimano (1975) conducted a study which showed that the enquiry approach allows the student to experience the process of science to learn through his or her experience, to think critically, and more readily to transfer what is learnt to new situations.

Watson (1976, p.60) pointed out that 'The aim of the Nuffield mathematics project is to devise a contemporary approach for children from 5 to 13. The guides do not comprise an entirely new syllabus. The emphasis is on how to learn, not on what to teach. Running through all the work is the central notion that the children must be set free to make their own discoveries and think for themselves and so achieve understanding, instead of learning off drills.' In addition, the Nuffield primary science project takes the environment as its starting point and its focus of attention, as well as using a discovery approach with greater freedom in the choice of topic selected (Bassett, 1970). The theories and ideas which underpinned the Nuffield science and mathematics for primary schools and the mathematics project are still current to-day [*e.g.*, Boyd (1984), Ingle and Jennings (1981), Moore (1979) and SPMG (1984)].

The science and mathematics classroom can make use of active involvement in a number of ways, but classrooms in Iraq in schools for hearing impaired children are extremely traditional and conservative. There are many problems in these classrooms which may be solved totally or partially by using teaching strategies, particularly to improve language and cognitive learning for hearing impaired pupils.

The learning materials (worksheets) were produced in science and mathematics for hearing impaired children in this study to allow such opportunities to be presented. The analysis of the materials will be explained at a later stage. However, they were designed to permit the development of methods based on good pedagogy (the principles of which are described in this chapter) for hearing impaired pupils and to encompass class teaching, individual learning, and group work (pairs) associated with practical work. The teacher was required to create opportunities to allow the child to learn on his/her own or sometimes with a partner, with the teacher available to help the child to structure what he/she has learnt. The teacher, as a result, becomes a facilitiator; one who asks questions, who co-investigates, who provides situations, as well as materials and who leads discussion (Beswisk, 1977).

Therefore, the teaching strategy includes:-

(i) Teaching Methods

(ii) Learning Materials

The main features of these are described below.

(i) Teaching Methods

These include:
- class teaching
- group learning
- individual learning
- discussion
- practical work

- Class teaching

The children are given a short introduction to a lesson in advance, as an overview of the learning materials. The explanation of each lesson to the whole class in practical methods is one way of getting children to understand these units. The ability to use questioning is an important teacher skill. Questions can be of many types, designed to develop the children's ability to think and express ideas. In addition, by class teaching, the teacher can direct the children's attention or get work organised (Dean, 1983).

Reynolds (1982, p.23) says 'whole-class teaching increases the contact between teacher and pupil, although the extent of the involvement depends on the teacher's skill in probing, querying and general stimulation'. The teacher of the hearing impaired is recommended to repeat what he says and to ask the children to repeat it as well - to improve their language (Dale, 1974). However, this approach is seen as a minor part of the teaching methods.

- Group learning

A pair of children at primary school, tackling a worksheet of mathematics or science to solve a problem, may benefit considerably by talking it through together (Dean, 1983). Dean also pointed out that this not only benefits the mathematical or science learning by making different aspects of the problem explicit, but it also makes demands on each child's language ability. This also applies to the situation in which one child teaches another. Children generally can help and learn from each other and the process of communication itself helps their understanding and develops both cognitive and social skills (Romiszowski, 1981). Linguistic ability can also be developed through the use of group strategies (Mogford, 1966). Priestly and McGuire (1982) in general stated fifteen advantages of learning in groups: expressing a point of view; conversational skills; exchanging information; sharing experiences; grasping concepts; giving and getting feedback; learning about self; learning about others; changing attitudes; learning new behaviour; increased self-confidence, problem solving and decision making; discussing feelings; working with others; and giving mutual aid and support. Generally speaking, small groups are more effective than large groups. Davies (1981, p.117) suggests that learners in small groups experience:

'- A greater sense of recognition as individuals.
- Greater personal satisfaction and morale.
- Increased feelings of achievement and progress towards a goal.
- A more accurate knowledge of results.
- Increased feelings of co-operation and friendliness.'

There is also a relationship between the size of a group and its achievement. Figure No. 3 illustrates this, Generally, as far as achievement is concerned, the Glass-Smith research in Davies (1981) pointed out that:

- In groups size larger than twenty, the number of learners in the group does not significantly affect achievement.
- In groups size between ten and twenty, increasing the number of learners beyond ten, affects achievement.
- In groups between one and ten, increasing the number beyond one dramatically affects achievement.

Thus learning is affected by the size of a group. Smaller groups are more efficient than larger ones.

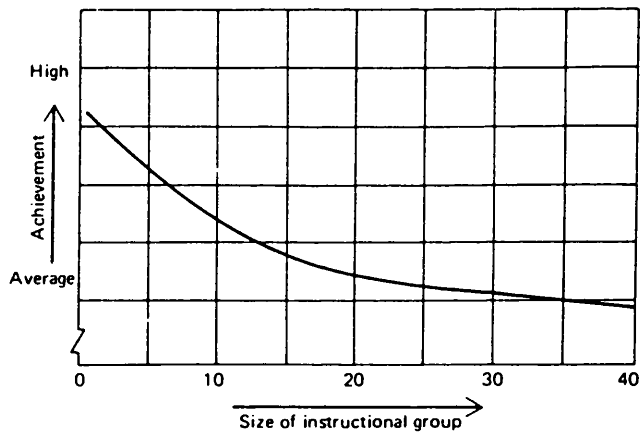


Figure 3 The relationship between group size and achievement, according to the Glass-Smith curve. (Adapted from *Phi Delta Kappan*, February 1979) in Davies (1981, p.117).

Nickson (1971) stated that an experiment carried out at the National Centre for Programmed Learning at the University of Birmingham indicated that group learning of some kind in fact improves motivation. In addition to this, there are opportunities for further learning activities, which may be initiated by the teacher or by the learners themselves as a group (Romizowski, 1981).

The importance placed on the role of group work can be seen within the context of the Nuffield science and mathematics project (Watson, 1976). This aspect was reinforced by the work of the ORACLE research project (Alexander, 1984). The Department of Education and Science (1985) reported that in primary schools and many special schools, children are arranged in groups of various sizes and for a variety of purposes. For example, they will be in small groups of two or three when practising particular oral, mathematical and physical skills. Group work also makes a positive contribution to children's learning because it recognises similarities among them and they interact with one another. The teacher, too, is able to give more attention to a group than could be given to each individual within it.

Therefore, group learning is very important because it helps the pupil's development (cognitively, linguistically and socially) and particularly that of hearing impaired children (Webster and Ellwood, 1985).

- Individual learning

Individualised learning is sometimes equated with independent learning, but they are not the same. Gagné (1975) pointed out that individual learning indicates that the pupil:

- supplies own motivation;
- confirms or selects objectives;
- discovers essential items;
- supplies own strategies;
- supplies own retrieval cues;
- thinks out generalisations;
- ascertains own performance; and
- provides own feedback.

Davies (1978), however, added that individual learning may be quite rigidly teacher-controlled.

Individual learning method, or self instruction, as Harris (1979) called it, usually refers to a formal organised or structured sequence of learning materials used by a student without the presence or assistance of a tutor. It is usually associated with formalised learning materials which are structured; for example, programmed learning, structured sequences. The structured sequences may, or may not, incorporate assessments. Therefore, individualised learning means that children at primary school work at their own pace through a structured scheme (Dean, 1983).

On the other hand, Rowntree (1982) suggests that individualised learning does not mean that the student is necessarily working on his/her own, although no doubt he/she will be alone at least part of the time, Individualised learning should mean that the objectives pursued by a student and the means and materials used are related to his/her personal needs and interests, rather than to the convenience of a whole class. Sometimes these ends and means will be suggested by the teachers; sometimes they will come from the student, but always they must be relevant to that student.

Dowdeswell (1981) indicated that the advantages below were claimed for the use of individual learning based on using a worksheet at comprehensive schools (teaching science for the first three years):-

- A great saving of time is achieved.
- Individual learning places greater responsibility on the learner.
- Able learners work faster than in traditional class teaching.
- Under conditions of individual learning, teachers find that their knowledge of individual learners is improved.

- Discipline in classes using independent learning tends to be improved. The use of worksheets is therefore particularly welcomed by inexperienced teachers, or those required to teach an unfamiliar subject.
- It brings enjoyment to many learners and teachers.

- Discussion

'Discussion' as Piaget stated, is very important to the children's development. Such an activity helps develop a child's linguistic ability as well as his/her logical abilities, through questioning.

Mogford emphasised the term 'discussion' in her writings about active learning (Nuffield primary mathematics, Bulletin 3, 1966). She pointed out that 'discussion is another important word, There is a far more permissive atmosphere in primary schools to-day, Children are allowed to move about freely, to handle materials, and above all, to talk. We are becoming increasingly aware of the close relationship between language and intellectual development. If we are concerned to develop children's thinking, then we must consciously foster the growth of language'. It is also helpful to get children to explain in their own words what they are doing, to improve their language and to consolidate the work (Paling, 1982).

The Cockcroft report (1982) stated that mathematics teaching at all levels should include opportunities for discussion between teacher and pupils and between pupils themselves. By this discussion, the whole relationship between teacher and pupil is built up, according to Richards (1982).

From the above it is clear that the use of discussion may greatly improve the work of the hearing impaired classrooms. Dale (1974, p.10) suggests that one feature of language programmes for hearing impaired children was 'the use of quite lengthy group oral/aural Piagetian sessions which contained much questioning, answering and discussion'. When the teacher is talking with a pair of hearing impaired pupils, or with one such pupil, this kind of discussion may have a particular value and when something new is being learned or some experience singled out, a small group working with the teacher may be the best possible way of consolidating learning.

- Practical work

Experiments as an aspect of practical work require children to be very active, as Piaget found out in his researches. The child must understand the components of the experiment, and then take part in the experiment as much as possible, so that he/she understands why something happens. Experiments are valuable when they make the abstract become more concrete.

Geddes (1973) states that we should give children opportunities in mathematics to apply their understanding and knowledge in solving real problems and therefore, children need practice in its application. To help children in primary school to progress in mathematics, as Paling suggested (1982), they should be involved in some practical activity, *e.g.*, each child handling objects, drawing, sorting, measuring...,. with a simple clear question to answer. Then they can go on to other similar activities and begin to see the general result which derives from all of these practical activities. Cockcroft (1982) reported that practical work is fundamental to the development of mathematics at the primary stage. Therefore mathematics teaching should include opportunities for appropriate practical work. The results of the practical testing carried out by the Assessment of Performance Unit and described in the reports of the primary tests illustrate clearly the need to provide opportunities for practical experience and experiment for pupils of this age. This is confirmed by Webster and Ellwood (1985), Dean (1983), Moore (1979), Harlen (1978) and SPMG (1984) amongst others.

Children aged 5-11 need to be familiar with fractions as a kind of number. The Department of Education and Science (1980, p.35) based on HMI observation, suggested that 'children should understand the notation of fractions and to be confident of their meaning'. They should be introduced to practical experiences such as cutting things up into equal parts, naming the parts properly and coming to understand the principle of equivalent fractions. This important stage of development will lead children to consider the comparison of fractions, equality, inequality, sum and difference of two fractions.

The project 'Science 5/13' emphasised practical work for children because it helps them to understand the environment in which they live (Harlen, 1978).

From visiting the units for the hearing impaired in the UK, practical work by pupils is used to consolidate learning and knowledge for the hearing impaired when they work as a group or individually, as well as the demonstration work which is used by the teacher to explain the lesson.

Myklebust (1964) postulates a hierarchy of sensory organisation in the hearing impaired person which takes the following order: visual, tactual, olfactory and gustatory. Gault (1926), however, adopted a very different approach by experimenting with the possibility of using the tactual avenue as the lead or major sense through which to develop verable language for the hearing impaired. Therefore, the use of practical work is not only to improve knowledge, but also to develop language.

(ii) Learning Materials

In Iraq, eduational technology is a new field and Resource Based Learning is not used in schools.

Resource Based Learning (RBL) is used as a vague term to describe a situation where the learning is not organised as formal instruction. Rather, by using materials such as worksheets and study packs, it incorporates media other than print. These media will include actual objects, displays, drawings and diagrams; they may also include audio recordings, video associated with visual display and film. In order to enable students to carry out guided discovery, a large bank of materials or resources is needed. This can include booklets, study packs, equipment, apparatus for science-based subjects and stored materials (audio tape, video tape, microfiche) to provide a base from which the learner can 'discover' (Harris, 1979). Therefore, RBL is a mode 'with many aspects and facets. When applied in practice, it may be short or long, structured or open-ended , teacher-directed or pupil-operated, subject specific or interdisciplinary, individualised or class-based' (Beswisk, 1977, p.104). Edmundson (1977, p.2) points out that RBL 'is now widely used to describe situations where the teacher is not working with a class in a formal, didactic manner. Pupils may work individually, or in pairs or small groups'.

Waterhouse, p. (in Megarry, 1976) summarises the advantages for RBL as:

- better learning because it can be adopted to individual differences and needs;
- more personal and adult relationships between teacher and pupil;
- greater administrative flexibility for absentees, remedial work, teaching at a distance;

- a wider audience to justify excellent and time-consuming audio-visual production;
- improvable, repeatable packages which can be borrowed by other teachers.

RBL has disadvantages as well as advantages. The possible disadvantages associated with worksheets are poor preparation, lack of an academic side, the creation of a superficial attitude to learning, difficulty in catering for more than one level of ability and failure to use a wide range of other references. RBL often lacks adequate assessment procedures. There are other potential disadvantages for RBL when associated with independent learning such as the lack of relationships between teachers and pupils. In this way, RBL may reinforce the isolation of the learner (Edmundson, 1977).

> <u>For the purposes of this study, the investigator understands RBL as a mode of learning with many aspects (worksheets, experiments, drawing, cutting paper....) which is structured, teacher-directed, subject-specific, individualised, group, or whole class based</u>.

The importance of the experiments, drawing, and cutting, has been explained under practical work, and there follows an explanation of the importance of the use of worksheets as learning materials.

Worksheets were designed as learning materials for the specific areas of mathematics and science because, as mentioned in Chapter 1, the hearing impaired do not have books.

The main aim of worksheets is to assist the pupils to learn (Weatherley and Beavis, 1981) and promote language development for all pupils by encouraging reading, writing, talking and listening (Beavis and Weatherley, 1980), as well as allowing better utilisation of scarce equipment and are almost essential for practical work in mathematics and science (Watson, 1976).

Dienes' Multi-base Arithmetic Blocks and Algebraic Experience Material were each based upon worksheet systems. He stated that 'it would probably be necessary to abolish almost completely the present method of class teaching with the teacher pontificating from a central position of power, and to replace this by individual learning, or learning in small groups from concrete material and written instructions, with the teacher acting as guide and counsellor' (Dienes, 1960, pp.19, 29).

Since worksheets are printed material and 'those who cannot hear must use eyes instead of ears to receive information' (Stokoe, 1976), they are useful for hearing impaired pupils. Rash's study (1966) confirmed this. She investigated the use of printed material on worksheets and demonstrated that visual material could be used to teach the child to make good sentences, complete with function words (such as verbs, pronouns...) and which were grammatically correct. The programme which Rash used was composed of 219 frames, illustrated by 66 separate pictures. It was divided into five sections, each with different but interlocking objectives. Each section was composed of a worksheet and a packet of cards mounted on rings, one card for each item on the worksheet. The child was instructed to match the number on each card with a number on the worksheet, to examine the word or illustration on the card, to fill in the blanks of the sentence on the worksheet, and to compare his reponse with the correct answer on the back of each card.

A system of worksheets should include the following characteristics (explained in the next section):

- The content and style must be related to unit purposes;
- the language must be at an appropriate level for the pupils;
- a simple system for recording and assessing progress which involves the pupils and promotes motivation such as record cards, or master guides (management system); and
- regular feedback to pupil on how he/she is progressing, possibly with remedial action built in.

3. Development of Learning Materials for Mathematics and Science

(i) Introduction

Hearing impaired pupils at primary special schools in Iraq do not have specialised books or teaching (see Chapter 1). Although Act No.126 in 1980 was intended to improve resources for these pupils, there has been no change in teaching strategies used in special schools.

During her visits to these schools, both as a student at the University and since, the investigator felt that hearing impaired children in Iraq needed assistance to improve their learning environment.

At the end of 1982, the investigator visited the centre for hearing impaired children and discussed with the Director of the Centre, Inspectors for these schools and some experienced teachers, the possibility of introducing a new teaching strategy designed specifically for the hearing impaired. They suggested that the new method should be used in the subject areas of mathematics and science, dealing with fractions in mathematics for grades 4, 5 and 6 and in science, plants for grades 4 and 5, and magnestism for the sixth grades (see Chapter 1).

(ii) Purposes, content and evaluation

The materials were produced for specific areas in mathematics and science, as previously mentioned. The materials include: class teaching, group learning, individual learning, discussion and practical work.

In the section devoted to learning materials it was pointed out that one of the characteristics of the worksheet system is that the content must be related to unit purposes. The 'Curriculum Committee' stated purposes for each of the above units. However, the investigator felt that these were general purposes and it was difficult to relate the content to them, especially in the fractions unit. Therefore, some purposes were determined for each unit after discussion with the Director of the Centre of the hearing impaired, inspectors of the schools for the hearing impaired and experienced teachers. One advantage of the limitation of the purposes was to facilitate the selection of content, teaching and learning methods and the evaluation of the pupils. Table 1 illustrates the purposes which were set out by the 'Curriculum Committee' and the investigator, and the content of each of the units 'Fractions, Plants and Magnetism'. The materials which were written for the above units were related to the investigator's purpose. In order to make the content of these materials more attractive, the worksheets associated with them were coloured pictures, tables, diagrams, *etc.*

It should not be forgotten, of course, that the language used in the construction of these materials must be at an appropriate level for the pupils, which forms the second characteristics of worksheets (previously mentioned).

Table 1 The Purposes and Content of the Three Units

(a) The purposes and content of the Fractions Unit for the three grades

Curriculum Committee's Purposes	The Investigator's Purposes	Worksheets Content
This unit should enable pupils to: - develop and orientate the individual's power to enable them to solve problems in mathematics; - understand and comprehend mathematical concepts and relations; - develop an interest in mathematics; - study mathematical thought in the following stages of study.	This unit should enable pupils to: - read, write and talk; - draw and label; - recognise that the concept of a fraction implies dividing something into a specified number of equal parts; - explain that the fractional part may be part of a unit; - explain that the fractional part may be part of a group; - identify the denominator; - identify the numerator; - explain that there is no one definite shape for ½, ⅓, ¼ and so on; - explain the addition of fractions; - explain the subtraction of fractions; - recall the way for finding equivalent fractions; - select a correct answer; - identify what are mixed numbers; - explain how to add the mixed numbers; - identify the relation between fractions and numbers; - develop an interest in studying fractions.	- fractions ½ - fractions ¼ - fractions ⅓ - fractions ⅕ - a fraction chart - fractions ¾, ⅔ - soldiers - group - coloured and non-coloured group - the name of one - a fraction has many names - the addition of the fractions - the subtraction of the fractions - all these mean 1 - fractions of coloured part - equivalent fractions - addition of fractions - subtraction of fractions - mixed numbers - a fraction chart - the adding of mixed numbers

Table 1 The Purposes and Content of the Three Units (cont.)

(c) The purposes and content of the Magnetism Unit

Curriculum Committee's Purposes	The Investigator's Purposes	Worksheets Content
This unit should enable the pupils to:	This unit should enable pupils to:	
- know some characteristics of magnets;	- read, write, talk;	- magnet
- acquire the skill of how to magnetise some iron objects;	- identify characteristics of magnets;	- magnetic force
- be aware of the importance of magnets in our life;	- do experiments using magnets;	- magnetic and non-magnetic substances
- do some experiments using magnets;	- prepare annotated diagrams of magnets;	- magnetic poles
- develop an interest in science.	- identify the magnetic and non-magnetic substances;	- the law of magnetism
	- explain magnetic force;	- magnetic fields
	- recall the law of magnetism;	- making magnets
	- acquire the skill of how to magnetise some iron objects;	- destroying magnetism
	- acquire the skill of how to remove magnetism;	- the use of magnetism in a compass.
	- recognise how to find directions using magnets;	
	- develop an interest in this unit.	

Table 1 The Purposes and Content of the Three Units (cont.)

(b) The purposes and content of the Plants Unit

Curriculum Committee's Purposes	The Investigator's Purposes	Worksheets Content
This unit should enable pupils to: - understand that plants are living things, and they are important in our life; - know plants are an important main source of food on the earth; - identify by experiment the function of each part of the plant; - be aware that sunlight is the main source available to plants to make their food. Plants cannot live without sunlight; - observe the parts of plants and the seeds through their growing; - develop an interest towards agriculture.	This unit should enable pupils to: - read, write and talk; - identify the parts of plants; - explain the function of each part of a plant; - observe the parts of plants and seeds through growth; - recognise that plants are living things; - explain why plants need water, light, air, warmth; - identify two types of plants (Annuals, Perennials); - describe each type of plants; - explain the importance of plants in our life; - recall how plants are an important source of food; - do some experiments using plants; - prepare annotated diagrams of plants; - develop an interest towards agriculture.	- the parts of the plant: roots, stem: leaves, flowers: seeds - the plant needs: water, light, air, warmth; - types of plants: annuals, perennials; - plants are important for human beings; - food, clothing, building, heating, other uses.

As mentioned above, the purposes facilitated the selection of the evaluation of the pupils. Matrices Nos. 1, 2 and 3 manifest the relationships between the purposes and the content of each unit and the method by which they were evaluated. The methods of evaluation will be elucidated later in the thesis.

Following on from this section, certain questions may arise as to why it has been so designed, does it coincide with the syllabus as previously taught, are these units written in a language appropriate to the children for which they are intended and what is the content of each worksheet. These matters will be addressed in the following sections.

(iii) Preparation of the materials

Various reviews of the whole sheets, as illustrated in Table 2, were carried out after consultation with the investigator's supervisor and before giving them to any validation groups. The first draft of the materials was then passed through two validation groups, one in the UK and the other in Iraq (see Appendix 4). Figure 4 illustrates the aims of the validation exercise by these two groups.

The information was passed to the investigator *via* direct conversation with members of the validation groups (see Appendix 5). The results were recorded and classified and the materials were adapted accordingly and then used. Table 3 manifests the changes made in the materials for mathematics and science units.

Boxes for storing the materials were made, as well as wall charts. All the equipment needed for the units was prepared.

The investigator demonstrated the purposes of the units, which related to the unit's content and the changes made to the materials.

CONTENT / PURPOSES This unit should enable pupils to:	Fractions $\frac{1}{2}$	Fractions $\frac{1}{4}$	Fractions $\frac{1}{3}$	Fractions $\frac{1}{5}$	Fraction chart	Fractions $\frac{3}{4}$, $\frac{2}{3}$	Soldiers	Group	Coloured and non-	coloured group	The name of one	A fraction has many names	Addition of the fraction	Subtraction of the fraction	All these mean 1	Fractions of coloured part	Equivalent fractions	Addition of the fractions	Subtraction of the fraction	Mixed numbers	Fraction chart	The adding of mixed number	EVALUATION
- read, write and talk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Test, observation, record card and interview
- draw and label	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Test, observation and record card
- recognise that the concept of a fraction implies dividing something into a specified number of equal parts	X	X	X	X	X										X								Test, observation and record card
- explain that the fractional part may be part of a unit																X							Test and record card
- explain that the fractional part may be part of a group																X							Test, record card
- identify the denominator													X	X			X	X	X			X	Record card and observation
- identify the numerator													X	X			X	X	X			X	Record card and observation
- explain that there is no one definite shape for $\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{4}$, and so on	X	X	X	X	X	X																	Record card and observation
- explain the addition of fractions													X					X					Test and record card
- explain the subtraction of fractions														X					X				Test and record card
- recall the way of finding equivalent fractions												X X					X						Test and record card
- selection of a correct answer							X	X	X	X													Test and record card
- identify what mixed numbers are																				X	X		Test and record card
- explain how to add the mixed no.																						X	Test and record card
- identify the relation between fractions and numbers															X	X				X	X	X	Test and record card
- develop an interest in studying fractions																							Interview

Matrix No.1 The purposes, content and evaluation of the Fractions Unit

CONTENT / PURPOSES: This unit should enable pupils to:	The part of the plant	Roots	Roots that store food	Stem	Stems that store food	Leaves	Leaves that store food	Flowers	Seeds	Seeds that store food	The plant needs:	water	- how plants respond to water	light	- how plants respond to light	Air	Warmth	Annuals	Perennials	Plants are important to human beings	Food	Clothing	Building	Heating	Other uses	EVALUATION
- read, write and talk	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Observation, test, interview and record card
- identify the parts of plants	x																									Test, observation, record card
- explain the function of each part of a plant	x	x	x	x	x	x	x	x	x	x																Test, observation, record card
- observe the parts of plants and seeds through growth									x			x														Test, observation, record card
- recognise that plants are living things						x																				Observation, record card
- discuss why plants nead water, light, air, warmth											x	x	x	x	x	x	x									Test, record card
- identify two types of plants (annuals and perennials)																		x	x							Test, record card
- describe each type of plant																		x	x							Test, record card
- explain the importance of plants in our life																				x	x	x	x	x	x	Test, record card
- recall how plants are an important source of food																				x						Test, record card
- do experiments using plants					x				x			x		x		x										Observation, record card
- prepare annotated diagrams of plants	x		x				x	x	x	x							x				x		x		x	Observation, record card
- develop an interest in agriculture																										Interview

Matrix No.2 The purposes, content and evaluation for the Plants Unit

CONTENT / PURPOSES: This unit should enable pupils to:	Magnet	Magnetic force	Magnetic and non-magnetic substances	Magnetic poles	The law of magnetism	Magnetic fields	Making magnetism	Destroyoing magnetism	The use of magnetism in a compass	EVALUATION
- read, write, talk	X	X	X	X	X	X	X	X	X	Observation, test, record card, interview
- identify characteristics of magnet	X	X		X						Observation, test, record card
- do experiments using magnets	X	X	X	X	X	X	X	X	X	Observation, record card
- prepare annotated diagrams of magnets	X	X	X	X	X	X		X		Test, observation, record card
- identify the magnetic and non-magnetic substances		X	X							Test, observation, record card
- explain magnetic force			X							Test, record card
- recall the law of magnetism					X					Test, record card
- acquire the skill of how tb magnetise some iron objects	X	X	X				X			Test, observation, record card
- acquire the skill of how to remove magnetism								X		Test, observation, record card
- recognise how to find directions									X	Test, observation, record card
- develop an interest in the unit										Interview

Matrix No.3 The purposes, content and evaluation for the Magnetism Unit

Table 2 Proposed materials and materials after reviews

	Proposed materials	Materials after reviews
1.	The materials include task card and item (see Appendix 2a)	Worksheet only (see Appendix 2b)
2.	Master sheet (see Appendix 3a)	Network, notes for teacher and record card [Teacher's guide (Appendix 3b)]
3.	Without cartoon	Include cartoon

Table 3 Changes made to the materials for the mathematics and science units

1.	The language was simplified (*e.g.*, words, numerator, denominator, *etc.*) to make words easier for the pupils at this age to understand. Sentences were shortened in the science units.
2.	The emphasis was placed on using practical methods to explain the point of the lesson. This is particularly important with hearing impaired children.
3.	The use of geometric shapes was considered to be preferable to using other shapes.
4.	It was considered necessary to include a glossary to explain some words to the children.

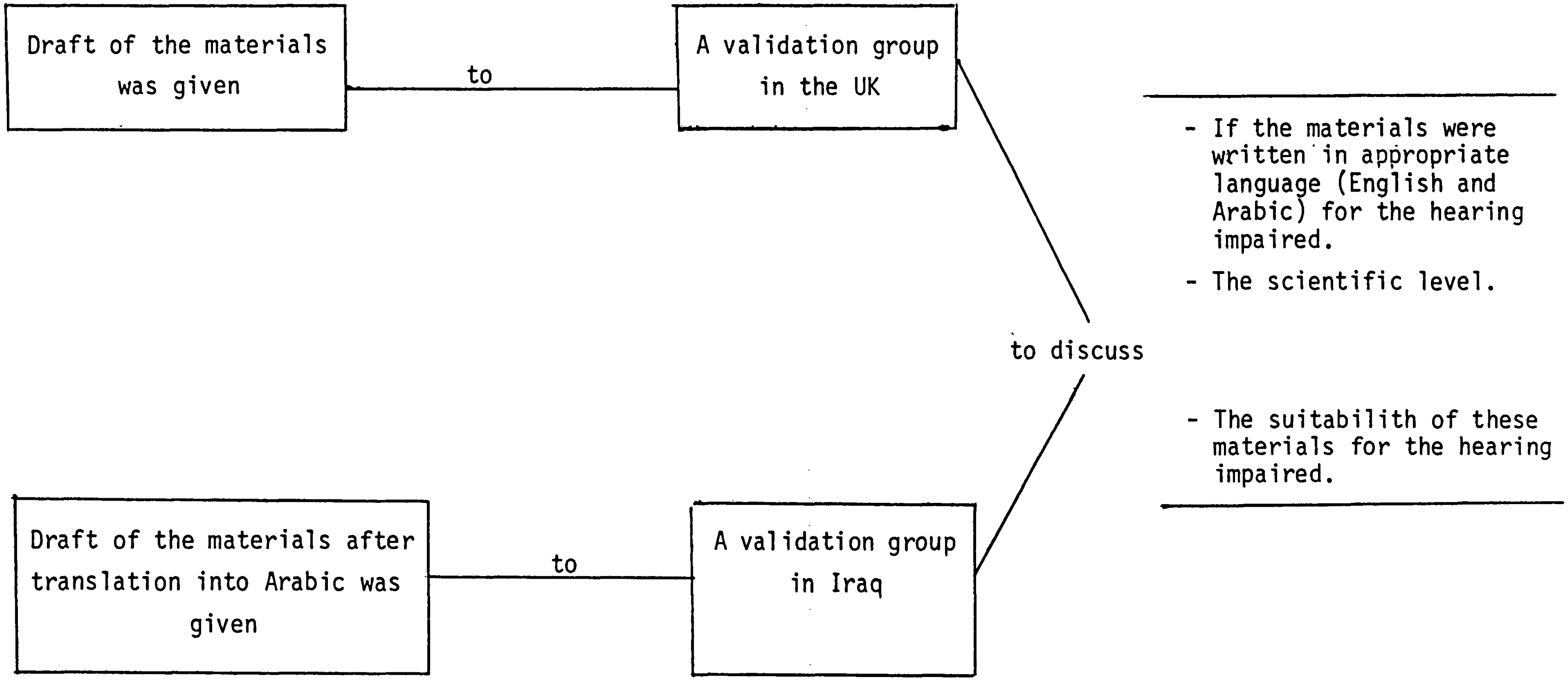


Figure 4 The aims of the validation groups.
(Obviously there could be misinterpretation in translation.)

The content of these units coincides with the science and mathematics syllabus previously taught, as stipulated by the 'Curriculum Committee'

- Science:
  - Grade 4: study of seasons, followed by Plants Unit
  - Grade 5: study of animals, followed by Plants Unit
  - Grade 6: study of air in our life, followed by Magnetism Unit

- Mathematics:
  - Grade 4: study of the addition of the whole number, followed by Fractions Unit
  - Grade 5: study of multiplication of the whole number, followed by Fractions Unit
  - Grade 6: study of division of the whole number, followed by Fractions Unit

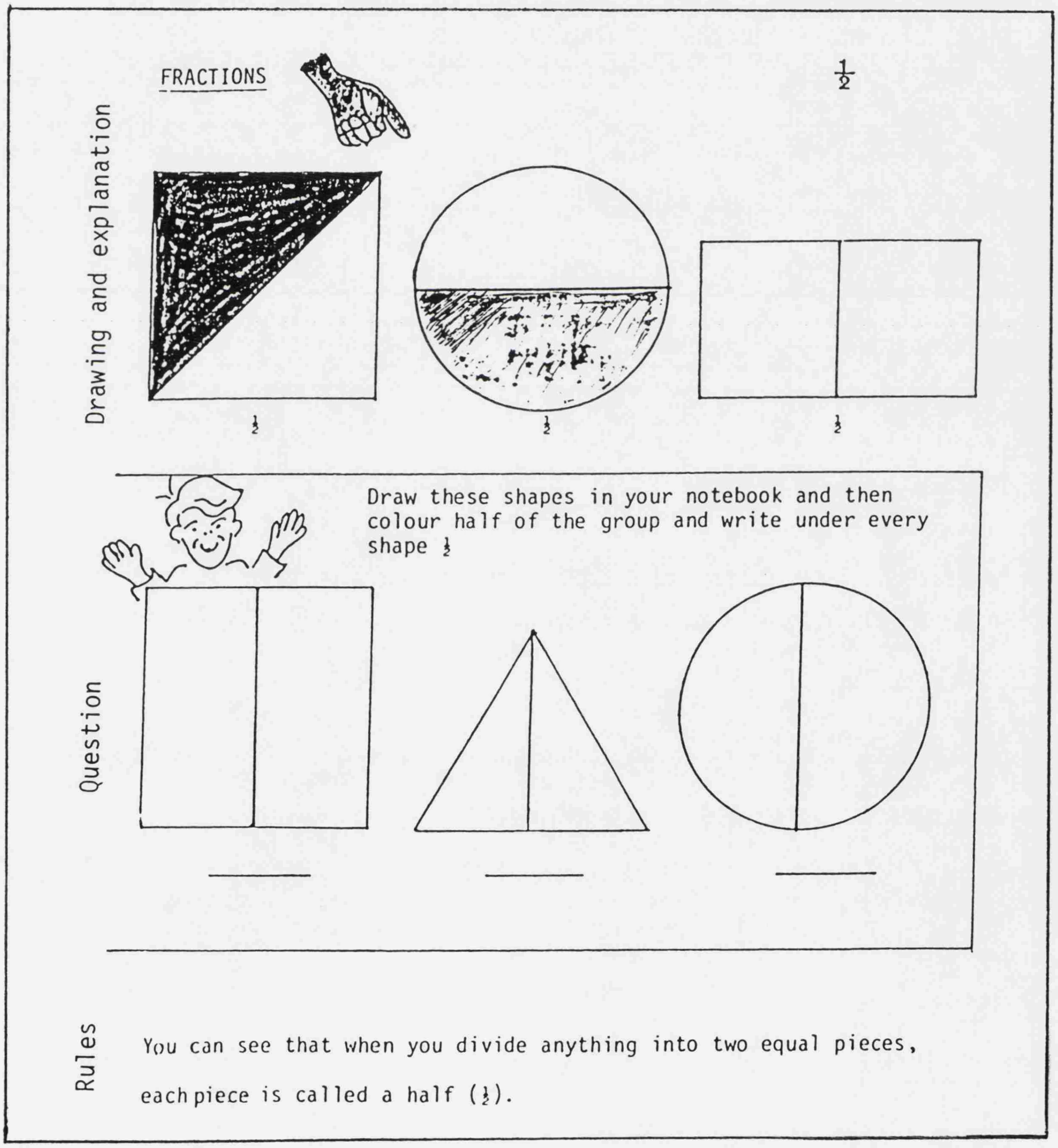
From the above, the investigator and the validation group in Iraq suggested that the content of the fractions unit should differ from grade to grade (see Appendix 6). However, the answers to the following questions can be found in the next section:-

- What does each worksheet include?
- Which worksheets involve the pupils in working as individuals, as groups, in discussions with the teacher, or in discussion with other pupils?

(iv) Analysis of the materials

In order to ascertain the content of each worksheet, an analysis of the worksheets based on some categories was carried out.

Categories used in the analysis of the mathematics materials (based on the Fractions Unit) included explanation, drawing, charts, rules and questions. Each worksheet also included cartoons which indicated headings and questions. The following example illustrates these categories and Matrix No.4 demonstrates the whole mathematics materials.



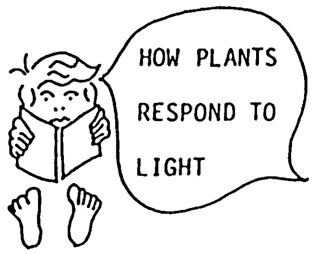
Matrix 4 Analysis of Fractions Unit Materials*

Worksheets content	Explanation	Drawing	Charts	Questions	Rules
Fractions $\frac{1}{2}$	X	X		X	X
Fractions $\frac{1}{4}$	X	X		X	X
Fractions $\frac{1}{3}$	X	X		X	
Fractions $\frac{1}{5}$	X	X		X	
A fraction chart	X	X	X	X	
Fractions $\frac{3}{4}$, $\frac{2}{3}$	X	X		X	
Soldiers	X	X		X	
Group	X	X		X	
Coloured and non-coloured group	X	X		X	
The name of one	X		X	X	X
A fraction has many names	X	X		X	
Addition of fractions	X	X		X	X
Subtraction of fractions	X	X		X	X
All these names[1]	X		X	X	X
Fractions of coloured part	X	X		X	
Equivalent fractions	X	X		X	X
Addition of the fractions[2]	X	X		X	X
Subtraction of the fractions[2]	X	X		X	X
Mixed numbers	X	X		X	X
A fraction chart	X		X	X	
The addition of mixed numbers	X	X		X	X

*Wall charts to be included.

For the Plant Unit, categories included explanation, drawing, experiment, observation and questions. Each worksheet included cartoons indicating headings, experiments and questions. The following example illustrates these categories and Matrix No.5 demonstrates the whole Plant Unit materials.

Drawing and explanation



Plants respond to light more than other living things. This is because plants need sunlight to make food and without sunlight they die.

In the forest, where plants grow thickly together, trees grow taller and taller to get sunlight. Have you ever seen tall, straight trees in the forest looking like giants trying to outgrow one another? They are competing for sunlight. Smaller plants growing in the shade of these tall trees do not always get enough sunlight and so in the end they may die.

Question

Copy the question in your notebook and then answer it.

Have you noticed that not much grass grows in the shade of big spreading trees? Why?

Discuss this with your friend.

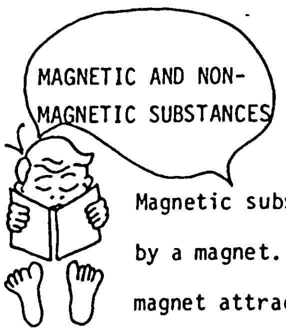
Plants send down roots to look for water. They must also send up stems carrying leaves to look for light. These stems always move towards the light, just as roots always move towards water.

Matrix 5 Analysis of Plants Unit Materials

Worksheets content	Explanation	Drawing	Experiment	Observation	Questions
The part of the plants	X	X			X
Roots	X	X			X
Roots that store food	X	X			X
Stem	X		X		X
Stems that store food	X	X			X
Leaves	X	X			X
Leaves that store food	X	X			X
Flowers	X				X
Seeds	X				X
Seeds that store food	X	X	X		X
The plant needs:	X				X
Water	X	X	X	X	X
How plants respond to water	X				X
Light	X		X		X
How plants respond to light	X				X
Air	X			X	X
Warmth	X				X
Types of plants	X				X
Annuals	X				X
Perennials	X				X
Plants are important for human beings:	X	X			X
Food	X				X
Clothing	X				X
Building	X				X
Heating	X				X
Other uses	X				X

In the Magnetism Unit, categories include explanation and as in the Plants Unit, each worksheet includes cartoons, drawing, experiment, rules and questions. The following example demonstrates some of these categories and Matrix 6 (shown overleaf) illustrates the analysis of the whole Magnetism Unit materials.

Explanation



Magnetic substances are things which are attracted by a magnet. They either pull the magnet, or the magnet attracts them.

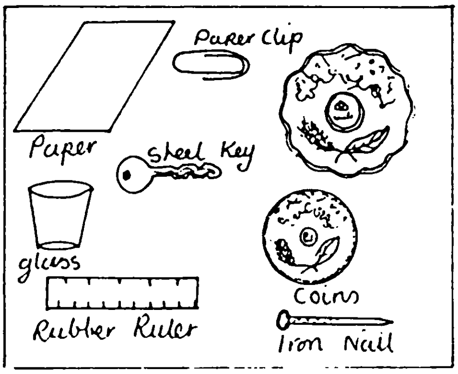
Non-magnetic substances are things which are not attracted by a magnet. Most of the things in the world are non-magnetic.

Experiment

Now do an experiment to find out which things in the picture below are magnetic substances and which are non-magnetic substances.

Take a magnet and see which things are attracted by it and which things are not. Work with your partner. Make a copy of the table below in your notebook. Record your result.

Substance	Magnetic or non-magnetic substance
1. Rubber	non-magnetic
2. Nail	magnetic
3.	
4.	
5.	
6.	
7.	
8.	



Question

Copy these questions in your notebook and then answer them in complete sentences.

a. Write down below some other non-magnetic substances you know of.......................................

b. Write down below some other magnetic substances you know of.......................................

Matrix 6 Analysis of Magnetism Unit Materials

Worksheets content	Explanation	Drawing	Experi-ment*	Rules	Questions
Magnet	X	X	X		X
Magnetic force	X	X	X		X
Magnetic and non-magnetic substances	X	X	X		X
Magnetic poles	X		X		X
The law of magnetism	X		X	X	X
Magnetic fields	X	X	X		X
Making magnetism	X	X	X		X
Destroyihg magnetism	X		X		X
The use of magnetism in a compass	X	X	X		X

*Experiment category included observation

The pupils worked to answer the questions in the worksheets for mathematics and science sometimes as individuals, sometimes as groups, in discussion with the teacher, or in discussion with other pupils. Appendix 7 illustrates the type of learning in each question in the worksheets for the three units.

There is no formal readability in Arabic, so it was not possible to use teachers' judgement of the suitability of the materials.

CHAPTER THREE: PILOT TRIAL STUDY

THE PILOT TRIAL

1. Introduction

The pilot trial could be regarded as a developmental testing of a new teaching strategies at a first stage in the design of the learning materials and teaching methods. Therefore it is seen to be useful in judging the likely overall value of the units and in indicating those features which require revision (Kelly, 1972).

2. The Pilot Trial School

There are seven primary special schools for hearing impaired children in Baghdad. One school was chosen at random as a pilot trial school by picking the name of the school written on a slip of paper which was in a bag with other slips containing the names of all the schools.

The trial of the new materials and teaching methods was carried out with three groups, the 4th, 5th and 6th grades - age range 9-14 years - of the hearing impaired pupils in this school.

3. The Aims of the Pilot Trial Study

The original aims of the pilot trial were to gather information about the following areas of interest:

- Suitability of learning materials for the 4th, 5th and 6th grade pupil population in this school.
- Suitability of the teaching methods for this population.
- In addition to the original aims, potential management problems were examined.

The pilot trial was solely concerned with the suitability of the learning materials and the teaching methods. Having designed materials and methods based on experiences in the U.K., the investigator needed to find out if these would be suitable for schools of hearing impaired pupils in Iraq.

4. Evaluation Strategy

A definition of the evaluation process is suggested by Cooper (1976) that evaluation is the collection and provision of evidence on the basis of which decisions can be taken about the feasibility, effectiveness and educational value of curricula. A similar definition of evaluation is by Rowntree (1982) that evaluation is an attempt to identify and explain the effects and effectiveness of the teaching/learning system. The teachers systematically collect and analyse information about the result of students' encounters with a learning experience. The insight, gained from evaluation, will help the teachers to develop and improve their teaching/learning, not just for the present students, but for future students as well.

The aims of the pilot trial of the new teaching strategy were to examine the suitability of the learning materials and the teaching methods and to find out whether there were any management problems. As Bloom (1978) stated, evaluation is useful in determining the relative effectiveness of the different approaches to instruction and learning.

Several questions were posed by the investigator such as what really happened in the classroom when the new methods were introduced? What interactions occurred between the learning materials, teaching strategies, the teachers and the pupils? What were pupils' reactions towards the course? Did pupils learn the course content? Did the new teaching strategies affect the language of the pupils? In order to answer these questions, a suitable evaluation strategy had to be chosen.

(i) Models of Evaluation: Experimental - Illuminative

Munro (1977) discriminated between two main modes of evaluation:

- The experimental model of evaluation, also known as the classical, traditional or agricultural-botanical model.
- The illuminative model of evaluation has also been called the responsive, analytical - judgemental or social - anthropalogical model.

The experimental model focuses the research efforts largely in terms of measuring pre-specified behavioural effects of the innovatory programme, as for example, in the evaluation studies of Champagne and Klopfer (1974), Anderson and Butts (1975), Brewer (1974) and Kaplan (1975). On the other hand, the illuminative evaluators see themselves much more as participant observers of the innovation-implementation process.

Harris, Bell and Carter (1981) described the illuminative model of evaluation as a process of "progressive focusing" where:

"- the evaluator enters the situation with as few prior assumptions and expectations as possible;
- attention is directed at the learning situation in its entirety, embracing both intended and unintended outcomes, for it is considered that 'separate' factors interact, and cannot be studied in isolation;
- the views and interpretations of all those involved are explored and portrayed;
- while remaining aware of the entire situation, in the light of experience, special attention is paid to those factors and issues which appear to warrant it.
- it is accepted that the picture which is constructed will be complex, acknowledging that learning is a complex process, with multiple realities.' (page 3.1, 1/2)

The illuminative evaluation is described by Parlett and Hamilton (1972, p.10) as 'unambiguously within the alternative anthropological paradigm', so it is not a variation on experimental evaluation models. It differs from experimental evaluation by its emphasis on 'description and interpretation, rather than measurement and prediction'. Illuminative evaluation claims 'to take account of wider contexts in which educational programmes function'. The experimental model of evaluation, on the other hand, emphasises measurement and prediction which is committed to pre-specified effects of behaviour. Most of the evaluation techniques used by the experimental evaluators are statistical and comparative. The experimental model of evaluation usually makes comparisons between the innovative programme and the taditional one. Comparative studies are made difficult where the new system supplants the old, rather than running as a controlled experiment. Hence Resource-Based-Learning (R.B.L.) may need to be evaluated in its own terms, rather than by reference to alternative systems. Attention needs to be paid, not just to the procedures and facilities of the instructional system, but also to equality of the learning process in human and academic terms (Parlett, 1977).

(ii) Roles of Evaluation: Formative - Summative

As has already been mentioned, evaluation is a central part of the curriculum development process. The roles of evaluation can be subdivided to formative and summative evaluation. Scriven (1967, p.41) describes the roles of evaluation in the following paragraphs:

> 'Thus it (evaluation) may have a role in the on-going improvement of the curriculum.'

> 'In another role, the evaluation process may serve to enable administrators to decide whether the entire

> curriculum, refined by the use of the evaluation process in its first (Formative) role, represents a sufficiently significant advance on the available alternatives to judge the expense of adoption by a school system.'

The first paragraph describes evaluation in its formative role, while the second paragraph describes evaluation in its summative role.

Formative evaluation is regarded as useful, not only for curriculum construction, but also for instruction and student learning and according to Knapper (1980, p.55) it can be an 'aid to the improvement of the instructional process itself. And an analysis of the nature of error can be used to modify the programme'. Therefore, formative evaluation is the use of systematic evaluation in the processes of curriculum construction, teaching and learning for the purpose of improving any of these processes. However, summative evaluation is primarily concerned with the grading or certifying of the students, judging the effectiveness of teachers and comparing curricula (Bloom, Hastings and Madaus, 1971).

The key distinction, as Stake (1977) sees it, between formative and summative evaluation, should rest on the distinction between information as a basis for generalisation and information as a basis for specification.

The strategy used in the evaluation of the pilot trial was illuminative in nature, with some quantative and objective supporting data in a formative role.

5. Methods of Collecting Information

In order to obtain information about the unit, a multi-method approach was used. The various methods were used with a view to obtaining a descriptive picture of units. These methods are:

(1) pre- and post-tests

(2) observation

(3) record card

(4) informal interviews with teachers and pupils

(1) Pre- and post-tests

It is not unusual to use pre-test/post-test evaluation methods for new programmes or for course improvement. The pre-test serves a number of functions when it takes place in evaluation studies (Burns, 1972).

A pre-test can be used to determine what knowledge and skills pupils possess before the beginning of a course. The information obtained from the pre-test assessment gives an indication as to whether or not the selected objectives are appropriate and consequently allows modification of the instructional materials and activities to be made in future planning.

A pre-test is vital when the information can be used to refine instruction, particularly to adapt this instruction to the prior levels of skills, abilities and knowledge of pupils.

A good reason for using a pre-test is to determine the extent of progress. Without a measure of how things were before a course started, one cannot point to the gains which have been made by the end of the course.

The post-test is used to measure the pupils' knowledge and skills at the end of the course.

The tests listed below were administered to pupils in the pilot trial school.

- <u>Attainment pre-tests 'Mathematics and Science'</u>

Mathematics and science pre-tests for the three grades were used to give an indication of how much information the pupils had about these units before they commenced the course. For this reason the tests did not cover the content of the unit for each grade and there was no scoring for each question.

- <u>Mathematics pre-test 'Fractions Unit'</u>

The fractions pre-test consists of four questions for the 4th grade, five for the 6th grade and six for the 6th grade (see Appendix No. 8).

- <u>Science pre-test 'Plants and Magnetism Units'</u>

The pre-test of the plants unit for the 4th and 5th grades consists of five questions (see Appendix No. 8).

The pre-test of the magnetism unit for the 6th grade consists of four questions (see Appendix No. 8).

- <u>Attainment post-tests 'Mathematics and Science'</u>

The aim of this test is to know how much the pupils achieved after they were taught these units. The post-tests were different from the pre-tests. The mathematics attainment test 'Fractions Unit' consists of five questions for the 4th and 5th grades and six questions for the 6th grade (see Appendix No. 9). The post-tests of science 'Plants and Magnetism Units' consist of ten questions (see Appendix No. 9).

Scoring for the above tests was decided by the teachers and inspectors after discussion with the investigator before the tests were administered. The scoring for the mathematics and science tests are presented in Appendix No. 10.

Validity of the attainment post-tests 'Mathematics and Science'

This term will be explained in detail in Chapter 4 (the language for the hearing impaired). Briefly, validity concerns the question of whether a test measures what it claims to measure. Content validity was the type of validity which was found with the above tests. The tests and the materials of the three units were read and discussed with the same validation groups mentioned before (see Chapter Two) in the UK and in Iraq after the materials and tests were translated into the Arabic language.

On this evidence, the tests can be regarded as valid, at least in relation to content. Matrices 7, 8 and 9 illustrate the relationship between the content of each unit and its test questions.

Reliability of the attainment post-tests 'Mathematics and Science'

The reliability of these tests is presented in the field trial (see Chapter Six) because the scores resulting from the field trial post-test were used to find the reliability.

(2) Observation

Observation was used as a means of collecting information about what was happening inside the classrooms. Classroom observation was used, together with other techniques such as tests and interviews, to provide information which was useful when making decisions about changes. Observation provides a useful starting point in locating issues of importance for improving an educational programme.

The aim of using observation is to find out what actually happens in the "black box" of the classroom whilst the learning materials are being used. Observing the classroom in action is the most direct way of achieving this. Brown (1981, p.117) states 'These observations can

Matrix No.7 The relationship between the content of the Fractions Unit and its tests

Question numbers in the test/ Content of the Fractions Unit	1	2	3	4	5	6
1. Fractions $\frac{1}{2}$						
2. Fractions $^1/_4$						
3. Fractions $^1/_3$						
4. Fractions $^1/_5$						
5. A fraction chart	X					
6. Fractions $^3/_4$, $^2/_3$						
7. Soliders						
8. Group		X				
9. Coloured and non-coloured group		X				
10. The name of one						
11. A fraction as many names						
12. The addition of the Fractions[1]			X			
13. The subtraction of the Fractions[1]				X		
14. All these name 1						
15. Fractions of coloured part		X				
16. Equivalent Fractions					X	
17. Addition of the Fractions[2]			X			
18. Subtraction of the Fractions[2]				X		
19. Mixed numbers						X
20. A fraction chart						X
21. The adding of mixed numbers						X

Matrix No.8 The relationship between the content of the Plants Unit and its tests

Question numbers in the test/ Content of the Plants Unit	1	2	3	4	5	6	7	8	9	10
- The Part of the Plants										
Root				X						
Roots that store food	X									
Stem				X						
Stems that store food					X					
Leaves		X		X			X			
Leaves that store food										
Flowers				X						
Seeds				X						
Seeds that store food										
- The Plant needs										
Water			X							
How plants respond to water										X
Light			X							
How plants respond to light										X
Air			X							
Warmth			X							
- Types of Plants									X	
Annual									X	
Perennials									X	
- Plants are important for humnan beings								X		
Food						X				
Clothing						X				
Heating						X				
Other uses						X				

Matrix No.9 The relationship between the content of the Magnetism Unit and its test

Questions numbers in the test/ Content of the Magnetism Unit	1	2	3	4	5	6	7	8	9	10
Magnet	X									
Magnetic force		X	X							
Magnetic and non-magnetic substances		X	X							
Magnetic poles				X	X					
The law of magnetism					X	X				
Magnetic fields								X		
Making magnetism										X
Destroying magnetism							X			X
The use of magnetism in a compass									X	

tell us much about the students' learning, often things that we could not learn by other methods'.

The observer should be aware of what and how much information should be collected. Harris, Bell and Carter (1981, p.2.2.1/4) note that 'observation and recording inside a classroom in a careful and systematic way can provide a great deal of information about what is happening. It is easy to collect more information than is immediately useful. If the person observing has a clear idea of why information is needed and how it may be used, attention can be directed towards events of particular interest'.

There are two types of instruments used to record the observation:

- immediate instruments,
- postponed instruments.

Immediate instruments are those in which the observation is recorded as the event occurs. However, postponed instruments are the most common instruments used for classroom observation. These observations are recorded after the observation period.

In order to record precisely what happened (by minutes) in the classroom, an immediate instrument (check list) was used to record the observation of pupils.

Observation methods may be used to study, as Payne (1974, p.374) says:

'- Individual and/or group behaviour,
- Instructional procedures and their influences,
- Student products and procedures,
- A variety of psychomotor and interpersonal behaviours'.

Hence, you can say that observation data may be used to study the interaction among individuals, groups and teachers.

The check list was designed consisting of four different sections:

1) The pupil by him/herself

2) The pupil with his/her group

3) Playing

4) Teacher talks to pupils

Each section was sub-divided into categories (see overleaf). During observation at the end of each two minutes, the activity of pupils at this time was recorded.

Validity of the observation check list

The observation check list is used during the course in the pilot trial to find out if it covers all the activities which are to be observed during the use of the new method. It transpired that the content of the observation check list did not measure what it was designed to measure, so a new section on practical work was added before the list was used in the field trial (see Changes section).

Reliability of the observation check list

There was a problem to ascertain the reliability of this list. The precise way to obtain the reliability of an observation check list is to record some lessons for each unit by a video and display it to a number of markers who are trained to make a tally (/) in the appropriate box if the behaviour occurs in the previous two minutes, as was done by the investigator for each obseration. However, at the time that this study was carried out, the investigator was unable to record the lessons on a video in Iraq. The only possibility was to hold discussions between teachers and the investigator after each lesson, for checking. There was complete agreement between the teachers and the

Observation Check List

[Make a tally (1) in the appropriate box if the behaviour occurs in the previous two minutes.]

Date:
Class:
Start time:

Minute Behaviour observed	2	4	6	8	10	....
<u>Section 1</u>						
- The pupil by him/herself						
1. Searching the materials						
2. Reading the materials						
3. Writing						
<u>Section 2</u>						
- The pupil with his/her group						
4. Talking to another pupil						
5. Talking to the group						
6. Listening to another pupil						
7. Listening to the group						
<u>Section 3</u>						
- Playing						
Behaviour and activities not related to the task						
<u>Section 4</u>						
- Teacher talks to pupils						
8. At pupil's request						
9. Without a request from the pupil						
10. By giving an announcement, talk, explain to the whole group/class						

investigator.

(3) Record card

There was a record card for each pupil in each unit. Much of the effectiveness of this sort of learning was based on the kinds of records that the teacher was able to keep. The teacher needed to know the following information about each pupil:

- what worksheets had the pupil completed?
- what strengths and weaknesses had been apparent in those completed worksheets?
- What marks had the pupil in pre- and post-tests.

The above information was also emphasised by Huppert (1982), Waterhouse (1983) and Foster (1979).

The teachers recorded their notes about each pupil. For example, Ahmed did worksheet No.1 and the teacher recorded that his drawing of shapes needed attention, but his solving of problems was alright (see Table No. 4). There was, in the lower half of the record card, the number of the worksheet, so the teacher crossed each worksheet which the pupil completed.

The pupils' record cards gave us an indication of their knowledge and language progress in both mathematics and science. It was therefore used as evidence to the other methods of collecting information.

(4) Informal interviews with pupils and teachers

A good way to find out how the course functioned was to ask the people involved. The author interviewed the teachers and pupils involved in the course. Interviews are useful procedures for gathering information about a new course or project. The purposes of the interview were to identify what a person knows, what a person likes or dislikes, and what a person thinks.

كارت التسجيل

الاسم : احمد

الصف الخامس

وحدة الكسور

الكسور $\frac{1}{2}$	✓
الكسور $\frac{1}{4}$	✓
الكسور $\frac{1}{3}$	✓
الكسور $\frac{1}{5}$	✓
جدول الكسور	✓
الكسور $\frac{3}{4}$ ، $\frac{2}{3}$	✓
الجنود	✓
المجموعة	✓
المجموعة الملونة والمجموعة غير الملونة	✓
أسماء الواحد	
كسور أسماء عديدة	
جمع الكسور	
طرح الكسور	
كل جزء = أسماء الواحد	
الكسور بعدد الملون	
الكسور المتكافئة	

التاريخ	الدرس	التعليقات
	$\frac{1}{2}$	حلت المسألة ولكن ليس بدقة وكذلك الرسم واحتاجت إلى مساعدتي لتصحيح الأخطاء.
	$\frac{1}{4}$	أكمل الطالب الأول حل المسألة الموجودة بالورقة وكتب العدد بصورة صحيحة.
	$\frac{1}{3}$	أكمل الطالب الأول الرسم واحتاج إلى مساعدتي لتصحيحه وأعاد الرسم مرة ثانية بصورة صحيحة
	$\frac{1}{5}$	أكمل الرسم بدون مساعدة وكتب الرقم.
	جدول الكسور	أكمل جدول الكسور بدون مساعدة وقص والصق الأوراق وليس بدقة. الآن أعاد عمله بدقة. وقد حل الأسئلة المتعلقة بهذه الورقة بصورة صحيحة مع الكتابة الصحيحة، وقد سألته أن يقرأ ما كتبه فقرأه بصورة صحيحة.
	الجزء الملون هو ثلاثة أرباع المنطقة	كان أول طالب أنجزه بصورة صحيحة.
	الجنود	وجد صعوبة في حل بعض الأسئلة ولذلك أرشدته للحل الصحيح بعد مناقشة ذلك وأعاد الحل بصورة صحيحة وحاول تحسين كتابته
	$\frac{3}{4}$ المنطقة ملون و $\frac{1}{2}$ المنطقة ملون	استسهل حل الأسئلة ما عدا السؤال الثاني فرع ب حيث أعاد حله.

الاختبارات	
القبلي	
البعدي	

رقم الورقة	١	٢	٣	٤	٥	٦	٧	٨	٩	١٠	١١	١٢	١٣	١٤	١٥	١٦	١٧	١٨	١٩	٢٠	٢١	٢٢
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓												

- Record Card.

Name: Ahmed Class: Five Unit: Fraction

Date	Task	Comments
	$\frac{1}{2}$	She answered question and completed the drawing in inaccurate way and she needed my help to correct her mistakes.
	$\frac{1}{4}$	The first pupil completed correctly the question in the worksheet and she wrote the number in righ way.
	$\frac{1}{3}$	The first pupil completed the drawing and she needed my advice to correct it. She drew again in righ way.
	$\frac{1}{5}$	She completed the drawing independently and the number.
	Fraction chart	She completed the drawing of the fraction chart and she cut it and sticked it not proparly but when redid it, it was good. She answered the questions in this worksheet proparly and she wort it proparly as well and she was asked to read what she has written and she did correctly
	The coloured part is $\frac{3}{4}$	She was the first one who did it correctly.
	Soldieres	She found some difficultries in answering the questions, Therefore, I guided her to the right answer after some discussion with her and she repeated the answers correctly and her writing was better.
	Fractions $\frac{3}{4}$ and $\frac{1}{2}$ was coloured.	She found easy to answered all the questions except question no 2_b, she redid.

Fractions $\frac{1}{2}$	✓
Fractions $\frac{1}{4}$	✓
Fractions $\frac{1}{3}$	✓
Fractions $\frac{1}{5}$	✓
A fraction chart	✓
Fractions $\frac{3}{4}$, $\frac{2}{3}$	✓
solidiers	✓
Group	✓
Coloured and non coloured group.	✓
The name of one	
A fraction has many names	
The addition of the fractions	
The subtraction of the fractions	
All these name 1	
Fractions of coloured part	
Equivalent fractions	

Tests	
Pre	
Post	

No. of sheets	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23...
	✓	✓	✓	✓	✓	✓	✓	✓	✓														

Table No.4 Example of the record card

In addition the interview can be used to test hypotheses or to suggest new ones; in conjunction with other methods in a research undertaking (Cohen and Manion, 1982, p.243).

Interviews are of two types, structured and unstructured. The structured interview is a closed situation and it is useful for gathering information about specific objectives. It is easy to carry out, but difficult to plan (Harris, Bell and Carter, 1981). The unstructured interview is an open situation, having greater flexibility and freedom (Cohen and Manion, 1982). Thus the interviewer is free to modify questions rather like in a conversation, but it has to be carefully planned.

Partially structured interviews are used with teachers and pupils for the pilot trial. Some core questions are used, but enough time is left for a conversational type of interview (see Appendix No. 11).

The procedure is useful with teachers, because they are willing to talk about their experiences with hearing impaired pupils both before and after the course. The procedure is also useful with pupils, because, being hearing retarded, they need an explanation of the questions and a free time to answer.

6. The Pilot Trial Study

The pilot trial study has been divided into the following sections:

I Learning materials

II Duration of the units

III Pupil population

IV Teacher population

V Training of teachers

VI Teaching methods

I Learning materials

The detail of the learning material is set out in Chapter Two. Beiefly, the learning material consists of three units: 'Fractions', 'Plants' and 'Magnetism' (see Appendix No.12 in English and microfiche in Arabic.

The Fractions unit consists of four topics for the 4th grade, six topics for the 5th grade and eight topics for the 6th grade. The Plants unit consists of sixteen topics for the 4th and 5th grades. The Magnetism unit consists of nine topics for the 6th grade.

A learner worksheet was prepared for each topic. Mathematics worksheets were written and duplicated from stencils, whilst science worksheets were written and photocopied.

II Duration of the units

The first lesson of mathematics for 4th, 5th and 6th grades was held on 12th April, 1983 and the last lesson of the 4th grade was held on 9th May, 1983. Four weeks of study were required to complete the unit (see Table No. 5). The last lesson of the 5th grade was held on 14th May, 1983. Four weeks and four days of study were required to complete the unit (see Table No. 5). The last lesson of the 6th grade was held on 21st May, 1983. Six weeks of study were required to complete the unit (see Table No. 5).

The first lesson of science for the three grades was held on the 13th April, 1983 and the last lesson for the 4th and 5th grades was held on 22nd May, 1983, six weeks of study being required to complete the Plants unit (see Table No. 6). The last lesson of the 6th grade was held on 16th May, 1983 and four and a half weeks of study were required to complete the unit (see Table No. 6).

Table No. 5 Summary of time required to teach Mathematics

Grade	No. of 50 minute periods*	No. of lessons weekly
4th	24	6
5th	28	6
6th	36	6

Table No. 6 Summary of time required to teach Science

Grade	No. of 50 minute periods*	No. of lessons weekly
4th	36	6
5th	36	6
6th	14	3

III Pupil population

Those pupils in the trial were from one school of hearing impaired children, and were selected from three grades of the last year of the primary school. The total number was 27 (15 boys and 12 girls). Table No. 7 illustrates the numbers in each grade.

Table No. 7 Summary of pupil population

Grade	Boys	Girls	Total
4th	5	3	8
5th	4	6	10
6th	6	3	9
Total	15	12	27

*The 50 minute periods were limited originally by their timetable and utilised where practicable.

VI Teacher population

The total number of teachers involved in the trial study was four: two mathematics teachers, one mathematics and science teacher, and one science teacher.

V Training of teachers - time and programme

In December, 1982, the investigator visited the school and met the teachers. The investigator then explained how hearing impaired pupils were taught in the U.K., and explained the materials which she was going to use in this school next term.

On 9th April, 1983, the above teachers were trained in the teaching strategy. The investigator explained to the teachers the learning materials and teaching methods, how to use them and what the teacher's notes should include; the nature of the pre-tests; the nature of the post-tests; and when to give the pupils these tests. Each grade was supplied with the necessary equipment and the investigator explained to the teachers when and where the equipment should be used.

VI Teaching methods*

Details about the teaching methods were outlined in Chapter Two. A short description is also given here.

The methods used for teaching the units in the pilot trial study included: a range of whole class teaching, individual or group work in pairs, combined with discussion and practical work.

Most hearing impaired children can, for example, learn the facts of a lesson, but in order to interpret the lesson content, one must have language, although language by itself is not sufficient to interpet what

*A video film is available with this thesis, is observed or heard. One needs to understand the content. Hearing impaired children often do not have the necessary language to express what they know.

Accordingly, the usage for variety of teaching methods, as mentioned about, included some which required language use to encourage the pupils to talk. In contrast, the traditional method which was used with pupils included class teaching only. In the traditional method (see Chapter One) the teacher taught the whole class by explaining some examples from a normal text book, using the blackboard. The pupils had no text books. The pupils copy summaries into their notebooks and these are marked by the teacher without discussing it with them. Regardless of the difficulties experienced by the pupils, the teacher moves on to the next unit.

With the new method, each lesson in each unit passes through the following steps:-

- Class teaching: the teacher explains each lesson to the whole class with practical demonstrations (see photographs Nos. 2 and 3) and the teacher asks them some questions to see if they have understood the lesson or not and also to make them talk.

- Individual learning: the pupils work with a worksheet individually (see photograph No. 4), reading the worksheet and answering the questions. When the pupil answers the questions which are in the worksheet individually, sometimes the teachers asks him/her to explain what he/she did in the work to the teacher or other learners in the class, to encourage talk. This is illustrated in photographs Nos. 5 and 6.

Photograph No. 2   The teacher explains the lesson in Mathematics

Photograph No. 3 The teacher explains the lesson in Science

Photograph No. 4 The pupils work individually in Mathematics

Photograph No. 5 A pupil explains what she did to the teacher in Science

Photograph No. 6 Pupils explain what they did to one another (Mathematics)

- Group: when two pupils (pair) work together, to do practical work or to answer the questions in the worksheet (see photograph No.7).

Photograph No. 7 Science lesson

- Discussion: in some of the worksheets, selected questions need discussion among pupils, or with the teacher individually, or in a group. This is illustrated in photograph No.8.

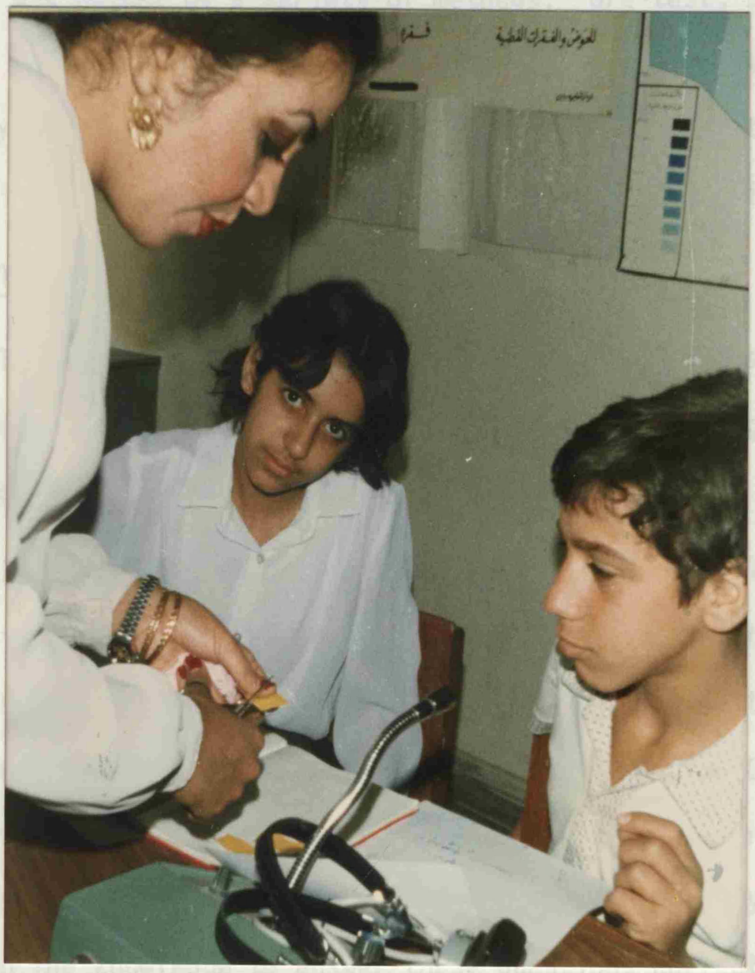
Photograph No.8 Science lesson

When the pupil answers the questions in the worksheet, the pupil gives the notebook to the teacher for checking, to see if there are any mistakes. The teacher discusses those mistakes with the pupil immediately, before he/she moves to another worksheet, as in the network, (see photograph No.9).

The teacher records all the information regarding the pupil's progress, lesson by lesson, on their record card.

When the pupils work individually, or in a group, the teacher tours the room to make sure that the pupils are spending their time working on their sheets. In addition, the teacher answers questions and helps pupils with any difficulties in reading or understanding (see photograph No.10.

Photograph No. 9 Mathematics lesson



Photograph No.10 Mathematics lesson

The management system was similar for the three units, 'Fractions', 'Plants' and 'Magnetism'. A 'Teacher's Guide' was also provided for each unit (see Appendix No. 3b), which included notes for teachers on how to teach the pupils in each unit. A network for each unit was also provided, to help pupils move from one worksheet to the next, together with a record card, glossary and a list of the equipment required.

A copy of the networks and the glossary lists were available for the pupils in the classroom, as well as the equipment needed in the practical work.

7. The Findings of the Pilot Trial

As has already been mentioned, information about the pilot trial study was gather by a variety of methods: pre-test, post-test, observation, record card and informal interview with teachers and children. The original aims of the pilot trial study were to gather information about the suitability of learning materials and teaching methods.

(1) The results of the pre-test

The teachers gave a pre-test to the pupils to test their prior knowledge of the units ('Fractions', 'Plants' and 'Magnetism') (see Section 5 for the details).

In the Plants and Magnetism units, no pupils replied to any questions. Since the teachers helped them to understand the questions, this suggests that they had no knowledge of these units. However, in the Fractions unit, the results (see Tables 8, 9 and10) showed that the majority of the pupils answered questions 1 and 2 correctly and two pupils in the 6th grade got question 3 correct. They may have acquired the knowledge to answer these questions correctly due to the existence in Iraq of ¼ Dinar, ½ Dinar and 1 Dinar bank notes, which the pupils know how to use.

Table No. 8 Results of the pre-test for the 4th grade ('Fractions' unit)

No. of questions / Pupil's No.	1	2	3	4
1	✓	✓	✗	✗
2	✗	✗	✗	✗
3	✓	✗	✗	✗
4	✗	✗	✗	✗
5	✓	✓	✗	✗
6	✗	✗	✗	✗
7	✗	✗	✗	✗
8	✗	✗	✗	✗

Table No. 9 Results of the pre-test for the 5th grade ('Fractions' unit)

No. of questions / Pupil's No.	1	2	3	4
1	✓	✗	✗	✗
2	✓	✗	✗	✗
3	✗	✗	✗	✗
4	✓	✓	✗	✗
5	✓	✓	✗	✗
6	✗	✗	✗	✗
7	✓	✗	✗	✗
8	✗	✓	✗	✗
9	✗	✗	✗	✗
10	✗	✗	✗	✗

Table No.10 Results of the pre-test for the 6th grade ('Fractions' unit)

No. of questions / Pupil's No.	1	2	3	4	5	6
1	✓	✗	✗	✗	✗	✗
2	✓	✓	✓	✗	✗	✗
3	✓	✗	✗	✗	✗	✗
4	✗	✓	✗	✗	✗	✗
5	✗	✓	✗	✗	✗	✗
6	✓	✓	✓	✗	✗	✗
7	✓	✓	✗	✗	✗	✗
8	✗	✓	✗	✗	✗	✗
9	✓	✗	✗	✗	✗	✗

(2) The results of the post-test

After the pupils had completed the units, the teachers gave them the post-test to test their knowledge. The aim of this test is to ascertain how much the pupils have achieved after being taught by these units (see Section 5 for the details).

Tables Nos. 11 and 12 illustrate the results of the post-test in Mathematics and Science for each grade (scored out of 100).

Table No.11 Post-test results for Mathematics*

Grade	N	$\bar{x}$ (Pts out of 100)
4th	8	95
5th	10	91
6th	9	92

*N = the number of pupils in each grade; $\bar{x}$ = the means.

Table No. 12 Post-test results for Science*

Grade	N	$\bar{x}$ (Pts out of 100)
4th	8	95
5th	10	93
6th	9	94

(3) Results of observations, record cards and informal interviews

The three units 'Fractions', 'Plants' and 'Magnetism' produced a favourable reaction with the majority of pupils. This was clear from the results of informal interviews with pupils and their teachers (4 teachers favourable, 24 pupils favourable and 3 pupils impartial). Observation had shown a similar result, which was also confirmed by the notes made on the record cards. A number of the observation check lists of some of the pupils and some of the record cards are presented in microfiche.

The learning materials were suitable for the pupils, when compared with the information passed to the pupils under the previous method of teaching science and mathematics. The results of the informal interviews with pupils had also confirmed this point (25 pupils favourable, 1 pupil impartial and 1 pupil unfavourable). The pupils were reluctant to leave the class when the bell rang and when the teacher asked them why, they said that they wanted to finish their work. Previously (before the application of this new method), they used to leave the class as soon as the bell rang. This suggested their preference for the new method of teaching. In addition, most of the pupils enjoyed working individually and with one another in pairs. They enjoyed working

*N = the number of pupils in each grade; $\bar{x}$ = the means.

in pairs becuase this method encouraged them to talk. When they worked individually, they felt that they had the freedom to work and to select what they needed. They also said they wanted to learn another subject by this method. They learnt new words, which was confirmed by the pupils themselves and by their teachers. The new method of learning (materials and methods) helped the pupils to improve their language in other lessons, as supported by the teachers (see below).

The majority of the pupils had no difficulty in working with the worksheets, according to the observations and record cards. They progressed easily from one activity to another, although they sometimes needed help from their teacher (19 pupils had no difficulty, 8 required help from one activity to another).

The teachers preferred this teaching strategy for hearing impaired pupils, because of the importance of practical methods and also because it helped the pupils to talk.

The teachers had no problem other than, for example, for the lessons in the Plants unit, where special arrangements were required for pupils to leave the classroom to bring in water, soil, *etc.* The problems were discussed on the same day with the teachers and the necessary arrangements made to overcome them. For example, pupils prepared the soil needed for the Plants lesson and also brought water in before the commencement of the lessons. During some other lessons, the teacher had to read the worksheet in front of the class, pupils being unable to do so for themselves, because the worksheet was handwritten.

8. Changes derived from the Findings of the Trial Study

Some technical changes were needed for the materials and the methods of collecting information to cover all the variables resulting from the findings of the trial study. These changes were made in four major areas: (a) typing the materials; (b) time limiting (c) pre- and post-tests; (d) observation check list; and (e) language test.

(a) Typing the materials

The materials for the three units 'Fractions', 'Plants' and 'Magnetism' were written by hand, as previously stated. The results of the trial study revealed that the pupils faced difficulties in reading some of these worksheets, because of the handwriting, according to the teachers. The material was therefore typed so that this problem did not arise in the field study.

(b) Time limiting

Observation showed that just 40 minute periods during six lessons per week were required for the 4th and 5th grades in Mathematics. However, the time taken at each lesson for the 6th grade in Mathematics did not change.

In Science, 40 minute periods at three lessons per week were required for the 6th grade, as noted from observation, but the 4th and 5th grades required the same time, as in the timetable (50 minute periods during six lessons per week).

(c) Pre- and post-tests

The pre-tests for the three units contained different questions from those in the post-tests, as previously mentioned (see Appendix No.8.9). The results of the trial study revealed that the pupils progressed in these subject areas according to the results of the post-tests. In order to know how much pupils would progress during the course, a comparison between pre- and post-tests would be used and both tests would therefore contain the same questions. The post-tests which were used in the trial study were adopted for use as both pre- and post-tests in the field trial study.

(d) Observation check list

The observation check list which was used to observe the pupils' behaviour in the trial study contained four sections: (1) the pupil by him/herself; (2) the pupil with his/her group; (3) playing; and (4) teacher talking to pupils. These sections can be further sub-divided into different categories (see page 67). The results of the pilot study showed that the practical work helped the pupils to improve their knowledge and language. It was therefore felt that the practical work had to be observed in addition to the other categories listed above. This was supported by Payne (1974, p.379) who stated 'Observation methods are individual's manipulative and psychomotor skills'.

(e) Language test

The results of the pilot study revealed that this teaching strategy was suitable for hearing impaired pupils. It helped to improve their knowledge and language. It was obvious that their knowledge developed, from the results of the post-tests of the units' content and other methods which were used to gather information. The idea about language development came from interviews and observation. Because the development of language is an important aspect, especially for hearing impaired children, a language test had to be developed to ascertain precisely the pupils' spoken and written language.

Full details regarding the language of the hearing impaired and the development of the language test are contained in the following chapter.

CHAPTER FOUR : THE LANGUAGE FOR THE HEARING IMPAIRED

CHAPTER 4

THE LANGUAGE FOR THE HEARING IMPAIRED

1. Introduction

Language can be defined as an instrument by means of which a child interprets and defines his experience. When he is unable to put this experience into words, it remains relatively nebulous and elusive (Jeffree and Cashdan, 1971).

In the present study, the author was particularly concerned with the use of spoken and written language in the communication of expressive ideas. Writing and speaking are essentially concerned with communicating meaning.

The ability of hearing impaired people for acquiring language is similar in some ways to people who learn a second language. The major points for second language learning have to be tested as:

- Relates to acquisition, not to learning.
- People acquire by understanding language a bit beyond current level of competence.
- Spoken fluency emerges gradually and is not taught directly.
- The use of meaning helps people to acquire language (Krashen and Terrell, 1983).

The investigator's conclusion from the above is that the child learns language through an interaction between the efforts of his own brain and events in the outside world. If the outside world does not provide enough input, then the child's brain will create its own secondary language. The child would rather use language the way he/she wants to, not as the adult wants him/her to. For example, creating new words and making silly rhyming words. So language may be learned, but not taught. Therefore the child organises the sensory inputs and constructs his own language system for himself.

This study is less concerned with direct language teaching and more with the acquisition of syntax, Lexis and grammar through the teaching of specialist subjects 'Mathematics and Science'.

The initial problem of the linguistic retardation of the hearing impaired is that 'the incoming language data are degraded through hearing loss. Even quite mild hearing loss can have a marked effect on language development' (Bench and Bamford, 1979). The hearing impaired have only the visual approach, which is being used as an avenue to the mind (Orman, 1953).

It is quite clear that a person cannot engage in spoken language expressively unless he understands the words to be used. Therefore, a pupil cannot begin to use the grammar if he does not know the meaning of words contained in the system. 'Perhaps a balanced approach to language instruction which incorporates the syntactic, semantic and experiential elements of the language system is needed' (Walter, 1978, p.82). It follows that there is also a need for hearing impaired children, in common with children with normal hearing, to acquire acceptable syntactical rules, and learning large numbers of words in isolation has been found to inhibit, rather than promote, the use of language by normal hearing (Ginsberg, 1960).

Hearing impaired children need to learn language in real and meaningful situations. Spoken language may be regarded as a way of representing experience and thought. It is one means of self-expression and personal communication with others. Therefore, spoken language should continue with discussion, questions and shared experiences. All children acquire and develop their language through relating to and re-counting their experiences through speech. However, the ability to listen and to understand is obviously a necessary prerequisite to full development of all language skills. Children 'normal hearing and im-paired' in the primary school are more able 'to take turns in a group and to listen to each other. They begin to realise that other people can interpret a situation in a way different from themselves' (Grant, 1977, p.22).

It is important to encourage children to talk and listen because there is a relationship between speaking and writing. It is obvious that the two proceed together, the listening becomes the speech and the speech becomes the reading and the reading becomes the writing. Once children have recognised that the spoken word can be expressed in written or printed symbols, they need varied activities in which they can use a fairly small number of familiar and meaningful words. Writing is im-portant, helping to collect and order ideas and knowledge. In the words of Ziff (1974, p.178) that 'written language is, of necessity, a major focus of the curriculum in classes for hearing impaired. To develop both written and oral expressive language, teachers in many classrooms have their deaf and hard of hearing children write daily'. In the report of the West Sussex County Council's investigation into the early and middle schools, it is stated that in order to write imaginatively, the child must have something to write about. The visual interest and stimulus of the environment caught the children's imagination, prompting them to express their opinions and thoughts in language (West Sussex

County Council, 1976).

Learning language can be considered as input and output. One cannot get results from the computer unless data are first put in. Teaching language by means of techniques and types of language stories described here is, in essence, putting data in the computer. Developing language is, by the same token, viewing the results. One way of understanding the results of language learning in children would be to analyse the production of language as results showing a picture stimulus. Ideally, the picture should present an opportunity for expressive and speculative speech. McGinnis, writing in 1963, referred to the positive effect of using pictures for language work with hearing impaired children. The child must draw on his past experiences (with language) in telling what might have happened to bring about the result shown in a picture used for building the story .

It is a fact that most hearing impaired children fail to acquire language skills both spoken and written, owing to what La Sasso (1978) called the environment variables. These include the type of educational setting, instructional method and materials employed to teach the hearing impaired. He considered that these factors were more crucial than the nature of their deafness and their level of cognitive. Pressnell (1973) found in his study that for hearing impaired children aged between 5 and 13 years 3 months, there was a delay in the acquisition of syntax for spoken language. He found notable differences in their developmental sequence of grammatical rules in spontaneous speech when he compared them with normal children of the same age, by using the North Western Syntax Screening Test. This test involved the scoring and analysis of a 50-sentence spontaneous language sample. It consists of two parts, receptive and expressive, each of which is made up of 20 sentence-pairs to be presented orally to the child along with appropriate pictures. He hypothesised that 'the differences found in the development sequence of grammatical rules for the hearing impaired children are probably due to the order in which the constructions were taught in the classroom and the visual auditory cues available to the child' (p.20). Watts (1979), having observed the teaching of mathematics to hearing impaired children, recognised that many teachers had not always fully accepted the idea that teaching mathematics must focus on both the language and the concepts. The teacher has an idea that mathematics can be taught without language. In order to improve the language of the hearing impaired, the concepts of mathematics must be taught too and children must be allowed to 'talk their way through' the concepts, not simply listen to the teacher's explanation.

Children should be active in their learning. Acquiring language and knowledge, according to Piaget, go hand in hand. Science activities are a natural way to increase a child's background of experiences. The activities use manipulatives to provide opportunites for pre-operational and concrete operational children to refine their observations and then communicate these observations to others. These activities are excellent for language experience, because they motivate students towards reading in search of answers about their observations.

Barrow *et al.* (1984) demonstrates such an application of language experiences in the teaching of science for normal children in grade k-3. They concluded that activity-oriented science allows each child to expand his/her own experiences, including vocabulary and comprehension of science concepts. Science language experience allows for the development of science skills and concepts, while stimulating pupils to ask questions and to respond through listening, speaking, reading and writing.

The investigator's hypothesis during this study is that hearing impaired children will acquire language by using the above method than by using the traditional method. This information provides a basis for the development of curriculum and materials especially designed to meet the language problems of hearing impaired children.

Wilbur and Quigley (1975) seem to suggest that vocabulary content and sentence length are important, but syntactic complexity is also important. Therefore, in the present study we are going to investigate the progress of the hearing impaired after they have had a course in Science and Mathematics. In addition to establishing the number of words or lengths of sentences used, the syntax 'analysis of the errors they made' and the quality of the content 'abstract-concrete' will also be recorded, by using a picture and asking the hearing impaired pupils to tell and write a story about the picture.

2. The Language Test

As far as can be ascertained, there is no Arabic test appropriate for spoken or written language. As mentioned in Chapter 1, the Reynell Developmental Language Scale is usually used in the U.K. However, this test was not used in the present study, for the following reasons:

- It is designed for children aged 1-6 years, yet children involved in this study were aged 9-14 years.
- A set of hard-wearing materials (*e.g.*, farmyard animals, dolls, toy furniture...) are used for the testing which is difficult for the investigator to provide for all the schools involved.
- It tested only spoken vocabulary and its meaning.

The North Western Syntax Screening Test, which was referred to in the previous section, was not used either, because this test is intended to be used as a screening instrument only; it is in no sense to be considered as a measurement of a child's general language skill, nor as an 'in depth' study of syntax, It will be useful for speech clinicians, "who need a short test for screening large numbers of children, as in a school setting, or for diagnosticians, who need to make a quick estimate of syntactic developments as part of a more elaborate speech and language evaluation" (Lee, 1971, p.3).

Another reason why the above tests were not used was that in this study, the investigator wanted to assess three aspects of spoken and written language (vocabulary, grammar and meaning). Nevertheless, the idea of evolving a picture language test emanated from these two tests, but in a different way, in order to find out the same information.

The picture story language test was first developed by Myklebust (1965) for several purposes, but the major objective was that it should serve as an instrument for the study, development and diagnosis of a language. It was used with both normal and handicapped children aged 7-17. The test can be applied in clinical and educational situations for the following purposes:

- To compare the advantages of various educational methods.
- To ascertain levels of written language ability for purposes of grouping and teaching.
- To define the errors of written language which characterise the performances of the deaf and other kinds of handicap.
- To obtain data for comparative analysis of the facility with the spoken and written word.

The size of the picture must be large enough to permit continuous viewing by 8 to 10 persons at a time; the ideal size is 10½ x 13½ inches.

(I) Aspects of the 'Spoken and Written' Test

There are three aspects of language which can be measured by the picture story language test:

(1) Productivity: the length of the expression, by ascertaining the:

- number of words (total words);
- number of sentences (total sentences);
- number of words per sentence (WPS),

(2) Syntax: the correctness of what is expressed, measured by:

- accuracy of word usage;
- word endings;
- punctuation.

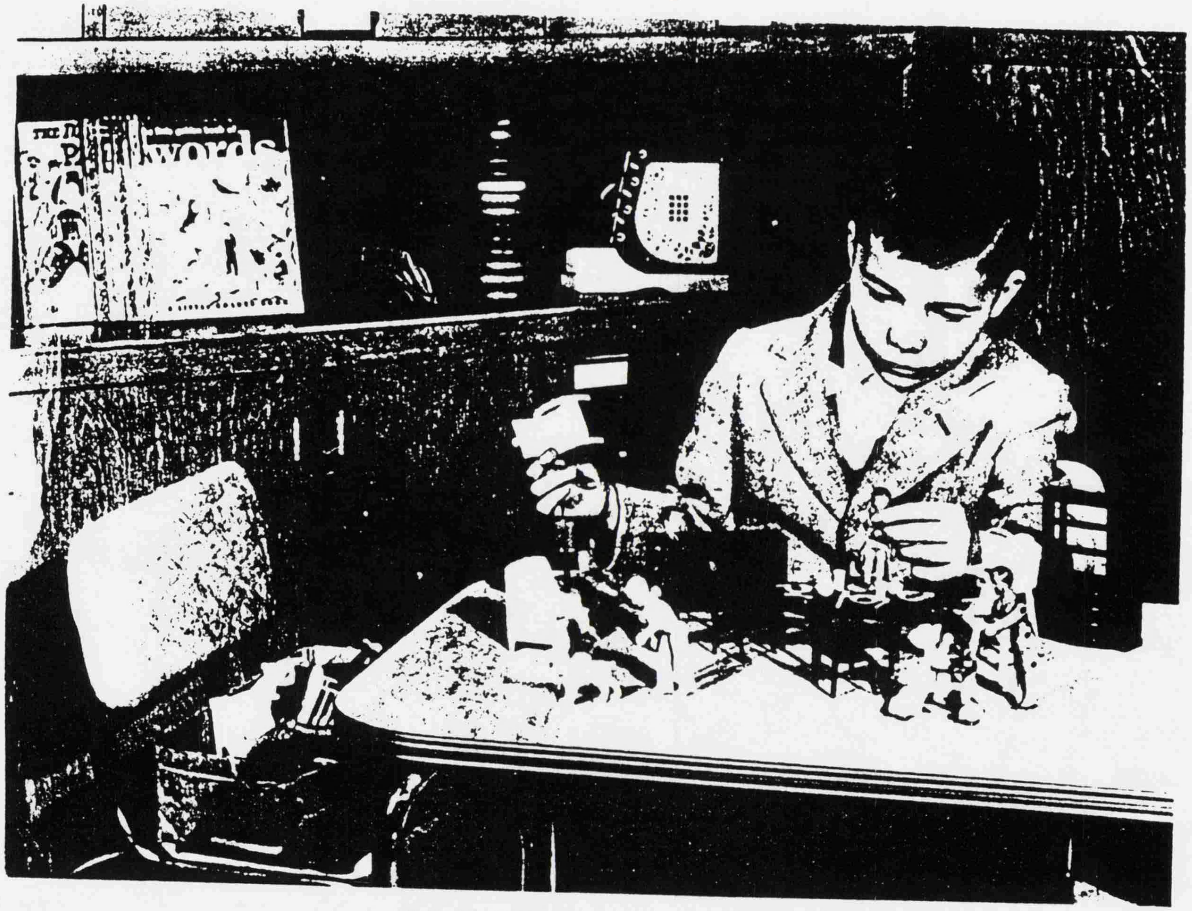
(3) Abstract-Concrete: the nature and meaning of the ideas being expressed as:

- meaningless language;
- concrete-descriptive;
- concrete-imaginative;
- abstract-descriptive;
- abstract-imaginative.

These categories can be further sub-divided. For example, in the case of word usage: additions, omissions, substitutions (see Appendix 13 for details of each aspect).

This particular picture story language test was obviously not suitable for cultural and linguistic reasons for Arabic speaking children. Therefore, another picture story language was designed to cover the teaching unit of Fractions, Plants and Magnetism, so that general and specific language was also tested (see overleaf).

It was especially important to modify the test to account for linguistic differences between English and Arabic. In the Arabic language a verb, noun, pronoun and adjective must change, following the grammatical rules because there are Gender, Singular, Plural and Dual rules to be taken into account. Table 13 illustrates these rules.



PICTURE STORY LANGUAGE TEST

(reproduced with the author's permission)

The modified picture

Table 13 The grammatical rules in the Arabic language

English			Arabic		
- Sentence			- Sentence		
The man	slapped	the boy	daraba	rrajulu	l waladah
noun phrase	verb	noun phrase	verb	noun phrase	noun phrase
i.e.,			*i.e.,*		
subject	past	object	past	subject	object
- Person			- Person		
She played			/La^{c}a b/et/ third person, feminine		
He played			La^{c}ab/a/ third person, masculine		
- Gender			- Gender		
There is no gender			Feminine La^{c}ab/na/ Feminine, third person plural	Masculine La^{c}ab/u/ Masculine, third person plural	
They played			Number → feminine and masculine		
- Noun			- Noun		
(s) plural and irregular plural			Plural, feminine Plural, masculine and irrgular plural		
- Adjective			- Adjective		
Single			Single Plural	feminine	
			Single Plural	masculine	
- Dual			- Dual		
There is no dual			There is dual and it is different in feminine and masculine		

(II) Principles for Marking the Modified Test

(1) Productivity scale:

- Total words (TW)

The number of words in a story are counted by taking into consideration the same factors which are listed in the American test (see Appendix 13), except the factor of initials and abbreviations, which are not used in the Arabic language.

- Total sentences (TS)

A story is divided into sentences by following the factors in the American test by using a dash after each sentence. However, in Arabic, the use of 'and' as connective is acceptable. It is usual to use 'and' at the beginning of the sentence, or for compound and complex sentences. Therefore, the use of 'and' is not an error.

- Words per sentence (WPS)

The principle for finding out the WPS is by dividing the total number of words by the total number of sentences (see Appendix 13).

Summary for marking productivity scale

Productivity scale	Marking
TW	Numbers of words in a story
TS	Numbers of sentences in a story
WPS	TW/TS

(2) Syntax scale:

As mentioned before, this scale consists of three categories which are subdivided (see Appendix 13). Apart from word endings, all other categories are not problematic, in relation to Arabic grammatical rules. In the modified test, word endings errors are made up of additions, omissions, or substitutions of either a prefix, infix, or suffix.

Summary for marking syntax scale

Type of error	Word usage (WU)	Word ending (WE)	Punctuation (P)
	Category of error		
Additions	1 point	⅓ point	⅓ point
Omissions	1 point	⅓ point	⅓ point
Substitutions	1 point	⅓ point	⅓ point
Word order	1 point	-	-

From the above it can be inferred that errors encompassing two levels of magnitude are scored on the syntax scale. The rationale for using this method is that whole word errors are of more consequence to meaning than part-word errors and errors in punctuation. In other words, the scale was devised so that the more consequential errors (those that most basically distort meaning) were allotted the greater penalty, as shown in the above table. The same system of points was used in the American test.

These values are required in order to ascertain the syntax quotient (SQ), as illustrated in Table 14 shown overleaf. The following symbols were used in the American test in order to designate incorrect usage, with the exception of word order:-

Type of error	Word usage	Word ending	Punctuation
	Category of error		
Additions	(/)	(E/)	(P/)
Omissions	(∧)	(E∧)	(P∧)
Substitutions	(~)	(E~)	(P~)
Word order	(↷)		

Table 14 Syntax quotient

Type of error	Category of error Word usage (WU)	 Word ending (WE)	 Punctuation (P)	TOTALS
Additions				
Omissions				(TO)
Substitutions				
Word order		/	/	
Totals	WU	WE	P	TE

Number of words (NW)	+	Total omissions (TO)	=	TOTAL UNIT (TU)
Total unit (TU)	+	Total errors (TE)	=	TOTAL CORRECT (TC)
	$\frac{TC}{TU}$	x 100	=	SYNTAX QUOTIENT (SQ)

(3) Abstract-concrete scale (A-C)

This scale was used as compiled for the American test. It consists of five levels and each level is subdivided (see Appendix 13 for details).

Summary for marking abstract-concrete scale

	Level	No. of sub categories	Range of scores
(i)	Meaningless language	-	0
(ii)	Concrete-descriptive	6	1-6
(iii)	Concrete-imaginative	6	7-13
(vi)	Abstract-descriptive	5	13-17
(v)	Abstract-imaginative	8	18-25

An Arabic illustrative story is shown on the next page, together with the score obtained as denoted above. A form was produced to record the information about each story (see Appendix 14).

Illustrative story written by hearing impaired child

البنت تطرز ملابس للدمية والولد يلعب بالمغناطيس ويجمع
الدبابيس وأمامهما كرسي ومطرقة خشبية وبجانبهما زرع
وورائهما مكتبة بالكتب عليها والساعة والمزهرية على
المكتبة وأمامهما مائدة يعملون عليها وعلى مائدة اخرى عليها
الزرع والبنت تلبس ملابس خضراء وحمراء والولد يلبس الأزرق
البنت شاطرة في دروسها وعملها والولد شاطر في دروسه
وعمله والمزهرية جميلة على المكتبة والساعة جميلة
أيضا والكرسي ملوث بالرصاص والخشبة متهوائية
والزرع اخضر والمائدة لونها اخضر فاتح والكتب لونها
بيدي والأخوجوزي والساعة لونها أصفر والمزهرية
لونها بالأسود البنت فرحة بالتطريز والولد فرح بلعبه

TW = 113; TS = 9; WPS = 12.56; SQ = 79.95; A-C = 6

(III) Pilot Runs of the Language Test

- The first stage of the trial was carried out in the Iraqi School in London. The investigator administered both the spoken and written test, during November, 1983. Both tests were given to the same group of seven normal hearing Iraqi pupils aged 8,* in order to find out if the modified picture was suitable for Iraqi children. Did it measure the three aspects of language as a preliminary indication? The stories which were written or told showed that the picture was suitable for them (see illustrative stories written and spoken, overleaf). The analysis of these stories revealed that the test measured the three aspects of language and especially the Arabic language. Tables 15 and 16 illustrate these results.

Table 15 The results of the spoken test

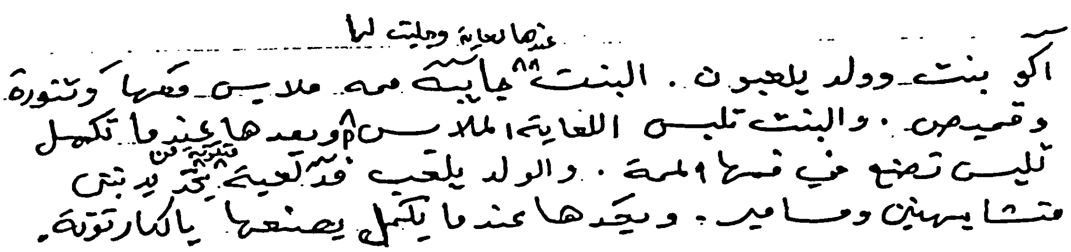
Test/ Pupils No.	TW	TS	WPS	SQ	A-C
1	45	5	9.00	75.98	8
2	16	3	5.33	73.42	7
3	26	4	6.50	91.26	3
4	28	3	9.40	72.93	3
5	35	6	5.83	75.62	7
6	26	4	6.50	66.67	6
7	77	8	9.63	90.95	14

Table 16 The results of the written test

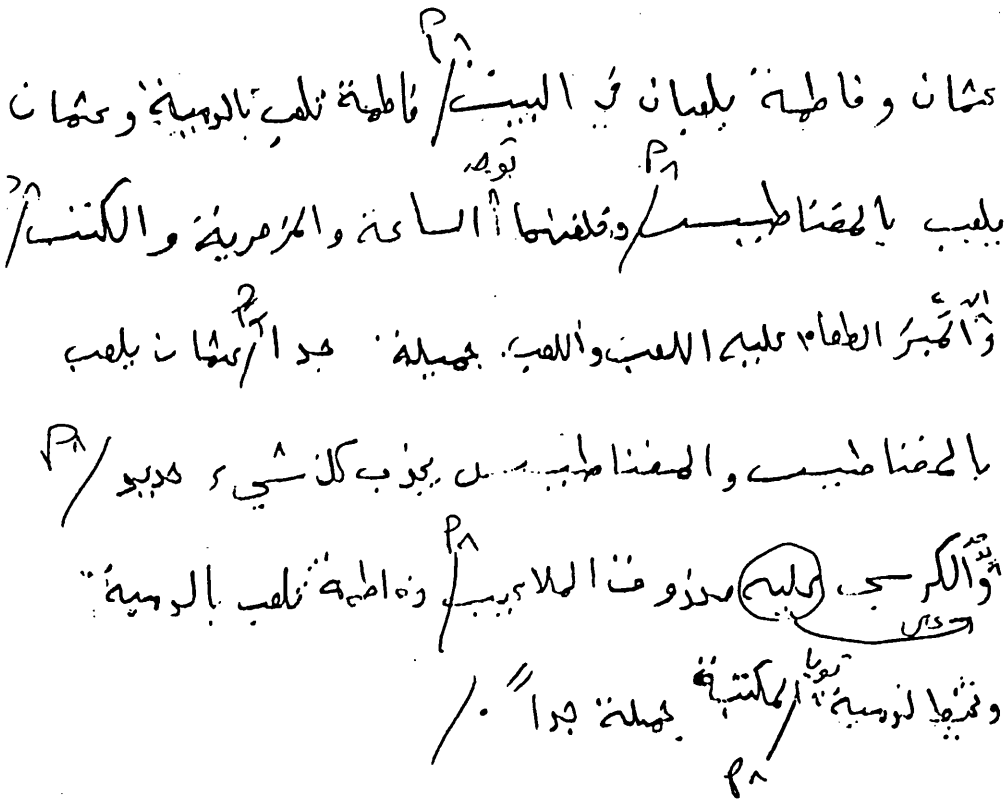
Test/ Pupils No.	TW	TS	WPS	SQ	A-C
1	53	7	7.57	87.63	10
2	21	4	5.25	71.59	6
3	20	3	6.67	70.59	3
4	25	4	6.25	76.56	3
5	18	3	6	91.51	7
6	23	3	3.33	66.20	3
7	14	3	4.67	49.97	12

*The School consists of different Arabic pupils, not only Iraqi, but the test was administered with Iraqi pupils only.

The conversation with three teachers at that school confirmed that this test covered the three aspects of the Arabic language and the picture makes ideas clear for the children. There was no problem when the test was used, merely some questions which the children posed with regard to the time of finishing, the length of the story (see p. 107) for more details).



Illustrative story 'spoken language' by normal hearing pupils aged 8 years



Illustrative story 'written language' by the same normal hearing pupils aged 8 years

- Ordinary Schools in Baghdad

The test was used with normal hearing pupils to identify common errors and the range of scores to compare later with the scores of the hearing impaired. Some initial evidence on validity and reliability was also gained.

1. Sample

- Schools:

Three mixed 'Boys and Girls' primary schools for normal children were selected randomly from three areas, according to the social economic status which are upper, middle and lower classes, as illustrated in Table No.17 based on a study on family income conducted by the Ministry of Planning (Al Nasiry, 1970).

Table17 The three areas according to S.E.S.*

Area	Name
Upper	Mansor (Centre)
Middle	Adamyia (Centre)
Lower	Saddam City (Kayara)

Appendix 15 gives details of the number of Schools in the three areas according to the sex and number of pupils in each area. One mixed school was taken randomly from each area: Dijla primary school from the upper area, Muhej primary school from the middle area, and Himreen primary school from the lower area.

- Pupils and Grades:

The three schools above were visited during December, 1983. Tables 18, 19 and 20 show the whole number of pupils at grades 2, 4 and 6. The sample of pupils was selected randomly by taking the number of each pupil as shown in the school record for each grade separately, from a bag.

*S.E.S. = social economic status.

Subsequently, 10 numbers were pulled out for each grade in each school separately. This meant that thirty pupils were selected randomly from each of the second, fourth and sixth grades of the above schools. Thus, the total sample comprised ninety pupils.

Table 18 No. of pupils at Dijla (Mansour) at second, fourth and sixth grades

Grade	Boys	Girls	Total
2	39	40	79
4	41	46	87
6	30	29	59
TOTAL:	110	115	225

Table 19 No. of pupils at Muhej (Adamyia) at second, fourth and sixth grades

Grade	Boys	Girls	Total
2	51	52	103
4	41	35	76
6	36	42	78
TOTAL:	128	129	257

Table 20 No. of pupils at Himreen (Saddam City) at second, fourth and sixth grades

Grade	Boys*	Girls	Total
2	5	48	53
4	2	71	73
6	4	39	43
TOTAL:	11	158	169

- Teachers:

The total sample had nine teachers, three in each school; the tutors of the class.

*The number of boys is less in this area, because of parents' preference for single sex education at primary level.

2. Administration of the test - Teachers' training

The investigator explained the research before the teachers were trained how to administer the language test to the selected pupils.

This training took several steps: the investigator asked the teacher to appear before the pupils and hold up the picture, so that all could see it. Then the teacher had to say 'Look at this picture carefully'. After a while, the teachers were asked to say to the pupils 'Write a story about it. You may look at it carefully; be sure to write the best story you can. Begin writing when you are ready'. Then the teachers were told to place the picture in a central position on the blackboard, so that the pupils could see it easily. The investigator then asked each of them to stay in the back of the classroom.

The teachers were told not to be surprised if the pupils asked some questions and to be natural in their answers. Such questions might relate to the time for finishing, the length of the story, or the title and words of encouragement were also an acceptable part of the teachers' task. The time was to be unlimited. (Teachers later reported that events followed this anticipated pattern. Some of the pupils asked if they could title the story or name the characters in it. Some of them said they could not write a story and they were encouraged to try.)

The pilot trial of the language test in the Iraqi school in London was used as an example to train the teachers.

The teachers were trained in their schools, each group of three teachers together. The training lasted on average about two hours. It took place on 10-12th December, 1983 inclusive.

When the actual administration of the test took place later that month, it was found that most pupils completed the story between 35-45 minutes.

One school was visited when the teachers administered the test and this observational check on procedure showed that the test was being conducted as planned.

3. Teachers' reactions and comments

First of all, the investigator faced some objections, because the teachers thought that the investigator would evaluate their abilities through the test. They expressed their reservations with comments such as 'children at second grade are too poor in their writing (dictation, vocabulary, imagination and length) to write a story'. Hence the investigator referred to the pilot run of the test in the Iraqi school in London and indicated that its purpose was nothing more than to know the abilities of the children in writing. This reassured those teachers who somehow felt that their competence as teachers was being assessed.

The investigator was also questioned as to why the test was being undertaken by normal children, since it appeared to the teachers to be for hearing impaired children. It was explained that this was being done because the test covered several common errors of language, similar for both normal and hearing impaired children.

Incidentally, one result of using the test in the three schools was their subsequent decision to approach creative writing tasks by using a picture stimulus, rather than simply providing pupils with the title of the story.

(IV) Validity

Validity concerns the question of whether a test actually measures what it claims to measure. Four types of validity are frequently described in the literature:

- face validity
- content validity
- empirical validity
- construct validity

- Face validity: is concerned with whether a test appears to measure what it is supposed to measure.

- Content validity: concerns the question of the extent to which the test adequately samples the universe or domain of items which it is supposed to measure.

- Empirical validity: refers to how well the test correlates with other measures of the same function, concurrent validity referring to other tests presently available, predictive validity referring to some measure to be made in the future.

- Construct validity: refers to the question of how far test scores are associated with traits, which theory relates to the quality being measured by the test.

Face validity was used as a way of establishing the validity of the test which was used in the present study. The test would claim to measure the three aspects of language previously described - 'productivity', 'syntax' and 'abstract-concrete' - both spoken and written. The administration of the test for the pupils at the Iraqi school in London (as mentioned in the 'pilot runs of the language test section) gave us evidence of face validity.

Content validity was another way of establishing the validity of this test. Content validity, as mentioned above, concerns the question of the extent to which the test adequately samples the universe or domain of items which it is supposed to measure. In the case of the present test, this concerns the adequacy of the selection of the aspects of the language.

The test was read and discussed with Arabic language experts at the School of Modern Languages at the University of Bath.

Empirical validity, as stated above, is concerned with how well the test correlates with other measures of the same function. However, there was no Arabic test available and therefore this way of establishing the validity was not used.

Construct validity was used as another way of estimating the validity of the test. Construct validity, as described on page 109 , refers to the relationship between the aspects of a test and the overall test score, *e.g.*, productivity, syntax and abstract-concrete are traits of language attainment and there should be a relationship between scores obtained on each aspect and the overall score obtained by the pupil. From the analysis of scores given to the stories of the normal hearing pupils, it was found that the overall scores were closely related to scores on individual elements and therefore it would seem reasonable to suggest that the test procedure has construct validity.

(V) Reliability

Test reliability concerns the stability in the scores that is in the stability of the relationship between object and measurement, when the test is administered by different examiners to the same subjects, or when it is administered repeatedly to the same subjects on a time dimension. There are three methods of estimating the reliability of a test:

- test-retest
- alternative form
- internal consistency

- Test-retest: is a method of estimating reliability which is exactly what its name implies. A group of students are tested and after a suitable time interval, the same group of students are retested. The reliability is based on the correlation between the first and second set of test scores.

- Alternative form: if alternative forms of the test are constructed, the correlation between the two forms may be regarded as a measure of the self-correlation of the test. This method is satisfactory only if sufficient time is allowed between the administration of the two forms of the tests. The interval between the administration of the tests is necessary to eliminate memory 'carry over' effects. The two forms of the test must be matched for content, difficulty and format.

- Internal consistency: The internal consistency of a test is determined from a single test administration. Hence, it does not involve a time interval, as do the test-retest and alternative form methods. One approach to determining the internal consistency of a test is called split-halves and the other way of estimating the internal consistency of a test is through one of the Kuder-Richardson methods.

(a) Spearman-Brown split-half method: The test is split into two equal parts and the total scores for each student on each half of the test are correlated. The internal consistency method of determining reliability is appropriate only when the test measures a unitary, homogeneous concept and not a variety of concepts.

(b) Kuder-Richardson estimate of reliability: This is based on item analysis and intercorrelation of individual test items with the test as a whole. The strength of this estimate of reliability depends on the extent to which the entire test represents a single, fairly consistent measure of a concept. This method yields somewhat lower estimates of reliability than split-halves, but higher estimates than the test-retest, or alternative form estimates.

If we look to the above methods for estimate reliability, it is difficult to employ it in the present study. Myklebust (1965) found, when he employed the test-retest method to find the reliability of his test 'Picture story language test' that there were unusual difficulties when applied to a test which measures developmental aspects of behaviour in children. It was found, in addition, that motivation for writing the second story would be more difficult to attain.

In addition to test-retest, the split-half method (odd-even) was employed to find the reliability of the syntax and words per sentence scores for the above test. Because of their nature, this method cannot be applied to Total Word, Total Sentence and Abstract-concrete scores.

It is known that the objectivity with which a test can be marked is related to its reliability. For this reason in particular, but also because criteria for marking written language has not been well established (Myklebust, 1965), Intermarker Reliability of each of the five scores was obtained.

Therefore, the investigator followed Myklebust to study the reliability of the present test by using intermarker reliability. The reliability quoted for the present test is calculated from the Ebel Formula. This method is used for estimating reliability for rating. If each of K markers has N stories on some trait on one occasion, we have the possibility of obtaining intercorrelations of markers of the N stories from all possible pairs of the K markers. This suggests the use of statistics known as the intraclass correlation, which gives essentially an average intercorrelation. Ebel's formula is:

$$*r_{11} = \frac{v_s - v_e}{v_s + (K-1)v_e}$$ [Guilford (1956) p.359]

It should be noted that this formula gives the mean reliability for one marker. The reliability of the mean of K markers for each story would be greater. For this, Ebel gives the formula:

$$r_{KK} = \frac{v_s - v_e}{v_s}$$ [Guilford (1956) p.359]

Therefore, the ninety stories were given to three markers, two teachers and the investigator, to mark them. The teachers were the most experienced teachers interested in doing the task (see Appendix 16).

On 25th December, 1983, the teachers were trained to mark these stories by having explained to them the way to indicate errors, details for meaning and scoring; each scale can be found on page 94 and Appendix 13.

The investigaotr then gave each teacher a photocopy of each story and each scale. The teachers were also supplied with a scoring form (see Appendix 14).

They gave the marked stories back on 5th January, 1984, The results for the three aspects of the language were analysed statistically using Ebel's formula, as illustrated in Tables 21-23.

$*r_{11}$ = reliability of ratings for a single marker
v_s = variance for stories
v_e = variance for error
K = number of markers

Table 21 Intercorrelation reliability for productivity scores

Grade	Total Words: Individual marking	Total Words: The three markings	Total sentences: Individual marking	Total sentences: The three markings	Words per sentence: Individual markings	Words per sentence: The three marking
2	0.99	0.99	0.99	0.99	0.84	0.94
4	0.99	0.99	0.99	0.99	0.95	0.98
6	1	1	0.65	0.85	0.70	0.87

Table 22 Intercorrelation reliability for syntax scores

Grade	Individual marking	The three markings
2	0.95	0.98
4	0.99	0.99
6	0.99	0.99

Table 23 Intercorrelation reliability for Abstract-concrete scores

Grade	Individual marking	The three markings
2	0.99	0.99
4	0.99	0.99
6	0.78	0.92

As mentioned previously (page 113) the mean of K markers for each story would be greater than the mean reliability for one marker. The reliability of the aspects Total Sentence and Words Per Sentence by the three markers was greater than by one marker. The reliability of the total sentences was low, because in the Arabic language there is personal controversy about the end of sentences, consequently the words per sentence are different, as well as the abstract-concrete. This was found in the sixth grade, because they wrote longer stories.

The results concerning intercorrelation reliability reveal that the test had high reliability and can be used with confidence.

(VI) Common Errors

The most common errors were in punctuation and in the use of word endings. These common errors will be compared with the common errors of the hearing impaired later.

After finding the validity and reliability of the language test, the test was used with hearing impaired pupils.

The next chapter deals with how this test was used as another method for gathering information about the course. The information which was gathered from this test was used in an attempt to ascertain the level of improvement of language use among the hearing impaired. To obtain the desired result, the schools for hearing impaired pupils were divided into two groups, namely 'experiment' and 'control'.

CHAPTER FIVE : A COMPARATIVE STUDY

CHAPTER 5

A COMPARATIVE STUDY

1. Introduction

The course for mathematics and science was tested in the pilot trial in one school with grades 4, 5 and 6, to find out the suitability of new teaching strategy 'Methods and Materials' with hearing impaired pupils in Iraq (see Chapter 3). Young (1967) advises that before an innovation can be recommended for more general use, it needs to be tried out in more everyday schools with more everyday teachers. Therefore, during the field trial, efforts were made to employ more schools for hearing impaired children and of teachers for field trials. This chapters covers the design of the field trial, while the course and the analysis of the results will be presented in later chapters.

2. The Field Trial Schools

There are eighteen schools for hearing impaired children in Iraq. Six of them are in Baghdad, in addition to the pilot trial school. The six schools which were in Baghdad were involved in the field trial study (see the map of Baghdad on page 117). These six schools were selected because there were considerable difficulties involved in visiting the country, which was at war at the time of the study. These difficulties were as follows: the nearest areas to Baghdad are about three hours journey and the other areas are about six hours away; there is no easy means of transport, as there are in the UK, for visiting these areas and it is difficult to stay there. There is also an economic problem - the policy of austerity which the government has adopted because of the war makes it difficult to spend money on the research.


BAGHDAD

These schools, as mentioned in Chapter 1, are supervised by the Ministry of Labour and Social Affairs, not related to the Ministry of education.

One of the six schools is for partially hearing children; however, the others consist of two departments, one for deaf children who communicate by using sign language, and the other for partially hearing children who communicate by using spoken language. Each child has an individual hearing aid and each class is supplied by group hearing aids.

The investigator's intentions were to include at the field trials more schools using the majority of pupil population and of teachers. The field trial therefore consists of grades 4, 5 and 6 at these six schools.

3. The Aims of the Field Trial

The original aims of the field trial were to ascertain that the new teaching strategy:

- develops the knowledge of hearing impaired children in specific subject areas in mathematics and science;
- develops the language both 'spoken and written' for hearing impaired children.

4. Study Strategy

One way of achieving the above aims was to follow Figure No.5, which represents the general study strategy which was adopted. In a comparative study such as this, the original considerations are that:

I identical subject areas' content should be used for each of the teaching methods;

II similar, or if possible, identical groups of pupils should receive different methods;

III the same tests should be used with both groups;

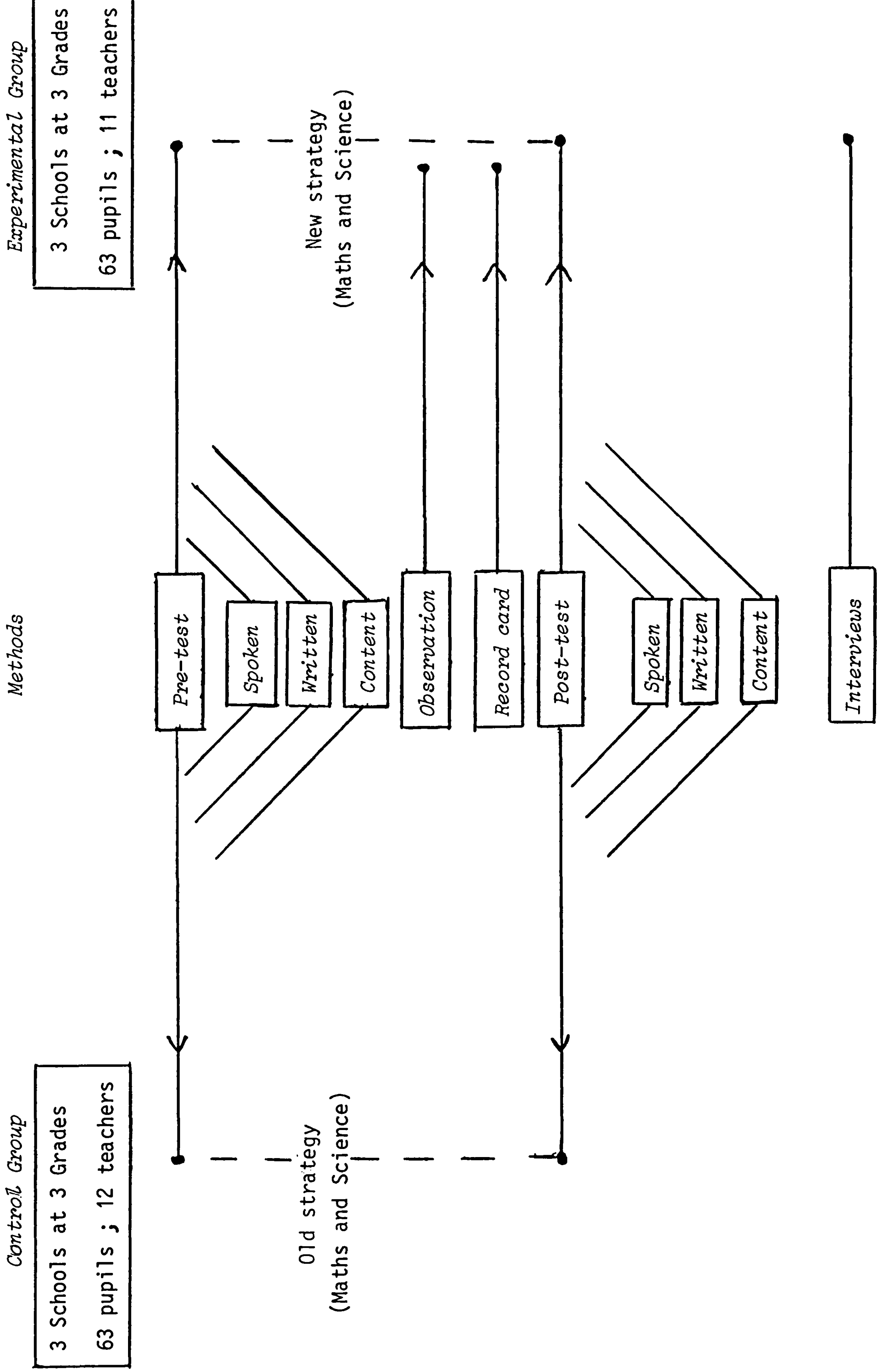


Figure No. 5 The Study Strategy

IV a sufficiently large number of pupils should be available so that a confident statistical comparison can be made;

V each group should be exposed to its particular teaching method for the same length of time,

The pilot trial evaluation suggested that there was a language improvement. Bearing in mind that the time interval for the new teaching method was about six weeks and that only part of the school time was taken up in the use of this method, the differences may be small. The language test, if it holds up on validity and reliability, could be used to measure differences, providing the test reliability was very high. The design of the groups must also allow for detection of small changes, which will need to be identified as significant. The design of this study was very specific, as shown below:

Control group which was taught by the old method in the two subject areas 'Mathematics and Science', the second group was taught by the new teaching strategies which were used in the pilot trial and called experimental group.

Each of the above groups consists of a number of schools. Each school consists of a number of grades. Each grade consists of a number of pupils. Therefore, it was found that within schools in the two groups there were matched grades and within these matched grades there were matched pairs. This will be explained later.

The above design facilitated the following statements:

I To find out if there were any significant differences between whole (control and experimental) groups (which means all grades in all schools, altogether in both groups), at pre-tests and if there were any significant differences of these same groups at post-tests, by using the Mann-Whitney U test.

II To find out if there was any significant difference between mean scores of pre-and post-tests for the same level of grades in the two groups (*e.g.*, grade 4 in all schools in the experimental group *versus* grade 4 in all schools in the control group and the same with grades 5 and 6) by using the t-test.

III To find out if there were any significant differences between mean scores of pre- and post-tests for matched grades [*e.g.*, grade 4 in school No.1 (experimental group) matched with grade 4 in school No.6 (control group) and so on] by using the t-test.

IV Matched pairs as a case study.

5. Methods of Collecting Information

There were no changes made to the criteria evaluating the course. However, as mentioned in Chapter 3, the attainment post-test (mathematics and science) was used as pre- and post-test and pre- and post-language tests, both spoken and written, were added to other criteria. A section of practical work was added to the observation check list (see Chapters 3, 4 and 6 for details).

6. Selection of Experimental and Control Groups

The six schools with three grades in each school (see Table No.24) were divided into two groups depending on the means (X) and standard deviations (SD) of each of the following factors: IQ, degree of hearing loss and the language test, and according to their ages and social economic status.

(1) Degree of IQ

All the pupils, before they were admitted to these schools, were tested for their IQ. These data were taken from their files. Table

Table No.24 The number of pupils in the six schools at the three grades

Grades / Schools	4th	5th	6th	Total
1	7	4	10	21
2	8	6	6	20
3	7	6	9	22
4	8	6	9	23
5	7	6	6	19
6	7	4	10	21
TOTAL:	44	32	50	126

Table No.25 The mean ($\bar{x}$) and standard deviations (SD) of IQ for the pupils in the six schools

Grades	Fourth grade		Fifth grade		Sixth grade	
Schools	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1	110.29	5.09	115.75	2.28	105.80	7.81
2	107.00	7.09	107.83	3.98	112.67	2.62
3	109.29	6.61	108.67	4.85	110.33	4.59
4	110.75	7.22	109.17	5.01	110.33	4.59
5	109.29	6.61	107.00	4.36	112.67	2.62
6	110.29	5.09	115.75	2.17	106.30	7.51

N.B. All of the data from the tests were prepared for statistical analysis in the computer. The data presented are from computer data; obviously $\bar{x}$ and standard deviation (SD) cannot be measured this accurately.

No. 25 shows mean ($\bar{x}$) and standard deviations (SD) for grades 4, 5 and 6 at the six schools. It reveals that the mean and standard deviations were about the same.

(2) Degree of hearing loss

As above, the degree of hearing loss was determined for all the pupils, before they were admitted to the schools for hearing impaired children. These data were taken from their files. Table No. 26 illustrates the mean ($\bar{x}$) and standard deviations (SD) for grades 4, 5 and 6 at the six schools. Again, it reveals that the mean and standard deviations were about the same.

Table No. 26 The mean ($\bar{x}$) and standard deviations (SD) of the degree of hearing loss by dB

Grades	Fourth grade		Fifth grade		Sixth grade	
Schools	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1	63.00	12.74	58.25	2.05	59.70	11.38
2	61.88	11.48	67.17	2.34	62.33	8.28
3	70.00	8.05	66.00	3.96	64.89	6.12
4	61.88	11.48	66,33	3.94	64.89	5,70
5	70.00	8.05	67,17	2.34	62.33	8.28
6	59.14	12.78	58.25	2.05	59.70	11,38

(3) Chronological age

The hearing impaired pupils in each grade in this study had the same distribution of chronological age in all the schools, The chronological age range of pupils included in the study was 9 to 14.

(4) Social and economic status

The social economic status was measured by the levels of education of the mothers and fathers (see Appendix No.17). It shows that the majority of the pupils' mothers are illiterate and their fathers can only read and write. Again, this information was taken from the pupils' files.

(5) Language test

The results of the language test (written) were used as another factor for selection of the experimental and control groups.

The picture story language test - see Chapter 4 for the details - was developed and used to test the hearing impaired language both spoken and written. However, only the written part of the above test was validated. The administration of this test was considered as a pre-test of the hearing impaired language.

1. Sample:
   - Pupils used in the study were all 4th, 5th and 6th grades in the schools, numbering a total of 126 pupils, as shown in Table No. 24.
   - Teachers - the sample of teachers for administering the the language test was 18 and they were the teachers of the classes which were included in the study.
2. Training of teachers for administering the language test:

The 18 teachers were trained together in one school. The training took the same steps as listed in 'Teachers' training in normal schools' (see Chapter 4). In addition, the investigator talked to the teachers about the administration of the test at the normal schools in Baghdad. The head of the Establishment of the Handicapped and the Director of the Hearing Impaired Centre were available during the training of the teachers.

3. Teachers' reactions and comments:

The investigator faced an objection from some teachers, who said that the hearing impaired could tell a story, but not write one. Therefore the investigator showed them some stories written by hearing impaired children (American Test). In some cases it was considered that the written stories were better than the spoken ones. The teachers were subsequently satisfied with the investigator's view and agreed to try the language test. Because of the above objection and in order to find out the level of improvement in the pupils' language after the course, the spoken test was also administered.

4. Administration of the test 'Spoken and Written'

Each teacher was supplied with one picture and a cassette. The spoken test was administered on the same day for three grades at the six schools. However, the written test was administered after two days, to avoid an identical story. The spoken test was not taken into consideration as a factor for the selection of the experimental and control groups. This was due firstly to the length of time needed for the analysis of the results and secondly to the fact that the spoken test was not validated.

5. Analysis of the scores

- Spoken language test: Table No. 27 provides the mean ($\bar{x}$) and standard deviations (SD) of the spoken pre-test for the three grades at the six schools.

The results reveal that there are differences between the mean for the same grade at the six schools for the three aspects of the test, as well as between grades. These differences among the means related not

Table No. 27 The results of the spoken language pre-test by mean ($\bar{x}$) and standard deviations (SD) for the three grades at the six schools

Schools	No. of pupils	TW $\bar{x}$	TW SD	TS $\bar{x}$	TS SD	WPS $\bar{x}$	WPS SD	SQ $\bar{x}$	SQ SD	AC $\bar{x}$	AC SD
GRADE FOUR											
1	7	15.00	2.56	2.57	1.05	6.80	2.82	46.95	7.18	2.29	0.88
2	8	17.50	7.65	2.88	2.15	7.90	3.95	55.05	13.89	1.63	0.69
3	7	21.57	7.17	4.57	1.18	4.74	1.10	53.46	10.02	1.43	0.49
4	8	17.63	8.56	2.38	1.41	8.61	2.80	56.28	14.87	1.63	0.69
5	7	21.57	5.47	4.57	1.18	5.13	1.91	53.99	12.02	1.71	0.70
6	7	14.00	3.25	2.43	1.18	7.23	3.69	51.53	12.13	1.86	0.99
GRADE FIVE											
Schools	No. of pupils										
1	4	19.00	6.28	4.50	1.12	3.35	1.54	58.64	4.82	1.50	0.50
2	6	19.33	1.70	4.33	1.25	5.07	2.15	49.70	8.21	1.33	0.47
3	6	20.00	7.26	4.50	1.61	4.59	1.02	57.48	10.56	1.83	0.69
4	6	20.67	5.53	3.53	0.96	6.15	1.54	55.30	12.58	2.17	1.08
5	6	19.33	2.81	3.50	0.96	5.89	1.48	49.20	9.59	1.67	0.75
6	4	20.75	5.80	4.00	0.71	5.09	0.55	57.00	5.35	2.00	0.71
GRADE SIX											
Schools	No. of pupils										
1	10	14.50	4.48	3.70	2.00	4.59	1.52	55.12	17.13	2.30	1.27
2	6	33.83	13.26	4.50	2.22	8.53	4.03	59.13	13.85	1.50	0.76
3	9	30.56	18.87	5.00	2.00	5.89	1.85	71.44	12.64	1.44	0.69
4	9	26.44	8.80	5.00	1.63	5.56	1.67	64.61	13.42	2.00	0.82
5	6	37.17	11.08	5.33	2.21	8.10	4.28	59.28	12.13	2.83	0.90
6	10	21.60	8.36	3.00	1.10	7.53	1.91	56.92	17.28	2.00	1.00

Key words: TW = total words; TS = total sentences; WPS = words per sentence;
SQ = syntax quotient; AC = abstract-concrete

only to pupils' ages and their degrees of hearing loss and IQ, but also to their language experience. Considerable variation in the standard deviations of these scores indicate considerable variability in the mix of groups making up the various classes,

- Written language test

The mean ($\bar{x}$) and the standard deviations (SD) for the three grades of the six schools in the test are illustrated in Table No. 28. The results of some aspects of the test show that there are differences between the mean for the same grade at the six schools, as well as the differences between different grades. These differences can be attributed to differences in pupils' ages and other factors mentioned above. Considerable variability again existed within class groups.

The results of the above factors revealed that school No.1 matched with school No.6 (the three grades). School No.2 matched with school No.4 (grade four) and with school No.5 (grades five and six). School No.3 matched with school No.5 (grade four) and with school No.4 (grades five and six). Table No. 29 show the above matching grades by mean ($\bar{x}$) and standard deviations (SD). In addition, an 'F' test was used to find out if there were any significant differences between the matching grades. All the results of the 'F' test were not significant at level 0.01 (see Appendix No. 18).

From the above matching, seven matched pairs were found at the six schools: one matched pair at fourth grade (see Table No.30), two at the fifth grade (see Table No.30) and four at the sixth grade (see Table No.30).

Table No. 28 The results of the written language pre-test by mean ($\bar{x}$) and standard deviations (SD) for the three grades at the six schools

Schools	No. of pupils	TW $\bar{x}$	TW SD	TS $\bar{x}$	TS SD	WPS $\bar{x}$	WPS SD	SQ $\bar{x}$	SQ SD	AC $\bar{x}$	AC SD
GRADE FOUR											
1	7	16.29	4.83	3.71	0.88	4.47	1.03	51.95	7.94	6.29	1.48
2	8	13.75	5.95	2.88	1.05	4.87	1.59	53.28	8.97	6.00	1.58
3	7	10.29	3.95	1.86	0.69	6.07	2.69	53.44	8.43	2.86	1.64
4	8	14.25	5.99	3.00	1.00	5.21	2.79	53.28	8.97	6.50	1.50
5	7	10.43	4.22	1.86	0.64	5.60	1.73	54.51	8.98	3.43	1.59
6	7	15.89	4.61	3.86	0.99	4.17	0.73	49.18	7.19	6.29	1.34
GRADE FIVE											
1	4	19.00	2.92	4,00	1.22	4.71	0.73	63.22	7.45	4.25	1.09
2	6	20.83	2.03	4.33	0.94	5.03	1.14	62.17	6,77	2.33	0.94
3	6	18.33	6.97	4,33	2.81	5.56	2.66	69.72	2.66	9.22	4.50
4	6	17.83	6.67	4.17	2.54	5.49	2.61	65.20	9.36	4.00	2.11
5	6	20.50	2.06	5.00	2.08	4.38	0.90	64.10	7.36	2.83	0.69
6	4	19.00	2.92	4.00	1.22	4.71	0.73	59.81	8.38	4.25	1.30
GRADE SIX											
1	10	22.90	5.07	5.70	1.62	4.18	0.95	55.83	13.49	6.50	1.12
2	6	21.50	4.23	4.67	2.69	5.80	2.31	63.41	11.20	6.33	1.11
3	9	32.56	5.52	6.67	0.82	4.90	0.66	76.64	10.94	8.67	2.00
4	9	32.56	5.52	6.67	0.82	4.90	0.66	72.45	10.20	8.56	2.06
5	6	21.67	3.90	4.83	2.73	5.74	2.54	63.41	11.20	6.33	1.11
6	10	22.90	5.07	5.70	1.62	4.18	0.95	55.83	13.49	6.80	1.08

Key words: TW = total words; TS = total sentences; WPS = words per sentence; SQ = syntax quotient; AC = abstract-concrete

Table No. 29 The scores of the written language test, degree of hearing loss, and intelligence quotient for the matched grades

Schools	No. of pupils	TW $\bar{x}$	TW SD	TS $\bar{x}$	TS SD	WPS $\bar{x}$	WPS SD	SQ $\bar{x}$	SQ SD	AC $\bar{x}$	AC SD	HD $\bar{x}$	HD SD	IQ $\bar{x}$	IQ SD
GRADE FOUR															
1	7	16.29	4.83	3.71	0.88	4.47	1.03	51.95	7.94	6.29	1.48	63.00	12.74	110.29	5.09
6	7	15.89	4.61	3.86	0.99	4.17	0.73	49.18	7.19	6.29	1.34	59.14	12.78	110.29	5.09
2	8	13.75	5.95	2.88	1.05	4.87	1.59	53.28	8.97	6.00	1.58	61.88	11.48	107.00	7.09
4	8	14.25	5.99	3.00	1.00	5.21	2.79	53.28	8.97	6.50	1.50	61.88	11.48	110.75	7.22
3	7	10.29	3.95	1.86	0.69	6.07	2.69	53.44	8.43	2.86	1.64	70.00	8.05	109.29	6.61
5	7	10.43	4.22	1.86	0.64	5.60	1.73	54.51	8.98	3.43	1.59	70.00	8.05	109.29	6.61
GRADE FIVE															
1	4	19.00	2.92	4.00	1.22	4.71	0.73	63.22	7.45	4.25	1.09	58.25	2.05	115.75	2.28
6	4	19.00	2.92	4.00	1.22	4.71	0.73	59.81	8.38	4.25	1.30	58.25	2.05	115.75	2.17
2	6	20.83	2.03	4.33	0.94	5.03	1.14	62.17	6.77	2.33	0.94	67.17	2.34	107.83	3.98
5	6	20.50	2.06	5.00	2.08	4.38	0.90	64.10	7.36	2.83	0.69	67.17	2.34	107.00	4.36
3	6	18.33	6.97	4.33	2.81	5.56	2.66	69.72	9.22	4.50	1.61	66.00	3.96	108.67	4.85
4	6	17.83	6.67	4.17	2.54	5.49	2.61	65.20	9.36	4.00	2.11	66.33	3.94	109.17	5.01
GRADE SIX															
1	10	22.90	5.07	5.70	1.62	4.18	0.95	55.83	13.49	6.50	1.12	59.70	11.38	105.80	7.81
6	10	22.90	5.07	5.70	1.62	4.18	0.95	55.83	13.49	6.80	1.08	59.70	11.38	106.30	7.51
2	6	21.50	4.23	4.67	2.69	5.80	2.31	63.41	11.20	6.33	1.11	62.33	8.28	112.67	2.62
5	6	21.67	3.90	4.83	2.73	5.74	2.54	63.41	11.20	6.33	1.11	62.33	8.28	117.67	2.62
3	9	32.56	5.52	6.67	0.82	4.90	0.66	76.64	10.94	8.67	2.00	64.89	6.17	110.33	4.59
4	9	32.56	5.52	6.67	0.82	4.90	0.66	72.45	10.20	8.56	2.06	64.89	5.70	110.33	4.59

Key words: TW = total words; TS = total sentences; WPS = words per sentence; SQ = syntax quotient; AC = abstract-concrete; HD = degree of hearing loss; IQ = intelligence quotient.

Table No. 30 The scores of the written language test, degree of hearing loss, and intelligence quotient for the matched pairs

Test	TW	TS	WPS	SQ	AC	HD	IQ
GRADE FOUR							
Matched	13.00	4.00	3.25	54.19	7.00	50.00	112.00
pair	13.00	4.00	3.25	53.00	5.00	53.00	112.00
GRADE FIVE							
First matched	18.00	3.00	6.00	50.63	4.00	60.00	113.00
pair	18.00	3.00	6.00	52.63	3.00	60.00	115.00
Second	11.00	1.00	11.00	70.06	3.00	66.00	113.00
matched pair	11.00	1.00	11.00	71.19	2.00	66.00	106.00
GRADE SIX							
First matched	28.00	8.00	3.50	47.84	9.00	71.00	100.00
pair	28.00	8.00	3.50	47.84	8.00	71.00	100.00
Second	18.00	4.00	4.50	48.58	7.00	53.00	100.00
matched pair	18.00	4.00	4.50	48.58	9.00	53.00	100.00
Third matched	18.00	5.00	3.60	46.50	5.00	68.00	99.00
pair	18.00	5.00	3.60	46.50	7.00	68.00	99.00
Fourth	28.00	7.00	4.00	82.19	7.00	67.00	112.00
matched pair	28.00	7.00	4.00	82.74	11.00	67.00	112.00

Key words: TW = total words; TS = total sentences; WPS = words per sentence; SQ = syntax quotient; AC = abstract-concrete; HD = degree of hearing loss; IQ = intelligence quotient.

Finally, schools Nos. 1, 2 and 3 were used as experimental group and schools Nos. 4, 5 and 6 were used as control group . The schools were divided into these two groups because schools 5 and 6 are in the same building and the pupils in the break play in the same place. Therefore, these two schools were control. However, school No.4 should be in the control group, because it was matched with schools Nos. 2 and 3. The above division facilitated the comparison between the groups, grades, matched grades and matched pairs.

CHAPTER SIX: THE COURSE

CHAPTER 6

THE COURSE

The experimental and control groups were the bases for the field trials. The new methods were used with the experimental group, while the control group continued to use the old 'traditional' method, but with the same content in 'Mathematics and Science', 'Fractions, Plants and Magnetism'.

1. Sample

- Pupils: in the experimental group there were three schools with grades 4, 5 and 6 of hearing impaired children. The total number of pupils was 63. There were also 63 pupils in the control group, which comprised the same number of schools and grades.
- Teachers: there were 11 teachers who were involved in the experimental group. However, there were 12 teachers in the control group.

2. Teachers' Training

Experimental group - the following teachers were trained in the teaching methods: 6 mathematics teachers, 3 mathematics and science teachers and 2 science teachers, who were all involved with the experimental group.

The teaching strategy 'Teaching Methods and Learning Materials' was explained to the teachers, how to use them and what the teachers' guide included, what the pre-tests were, what the post-tests were, and when to give the pupils these tests.

In addition, a video film from the pilot trial was presented to the teachers and some photographs for the pilot trial were also shown, (see Supplementary Materials).

The teachers brought the necessary equipment and the investigator explained when and where this equipment should be used.

Control group - the following teachers were involved in teaching the control group: 9 mathematics teachers and 3 science teachers.

The pre- and post-tests of Mathematics and Science were explained to the teachers and when those tests should be administered. However, the teachers continued to use their normal methods to teach the pupils.

There was no circulation of information from the experimental group to the control group, due to the following:-

- The schools are situated over a wide area, as shown previously in the map of Baghdad (see page 117), which made contact between them extremely difficult.
- No effort was made for any meeting of the groups during the period of the study.
- Lack of personal communication and co-operative work.

3. Teachers' Reactions and Comments

The teachers in the experimental group wanted to know what would happen if the inspector visits and sees the new teaching methods in operations and the consequent changes in the classrooms. How would the inspectors evaluate the teachers under these circumstances? The investigator explained that previously the inspectors had been informed of the planned experiment. If the inspectors visited the schools, they would only be interested in the new methods and would not be evaluating the performance of the teachers.

There were no comments from the teachers of the control group, however, since they were happy to have the content of what they were to teach in that term.

4. Execution of the Field Trial Study

(1) Teaching strategy for the experimental group

- Learning materials: the materials used in the pilot trial were those used with the experimental group in the field trial. These consisted of three learning units, 'Fractions', 'Plants' and 'Magnetism'. Learners' worksheets were prepared for each learning unit (details outlined in Chapters 2 and 3). The worksheets were typed and duplicated.

- Teaching methods: the new teaching methods for mathematics and science included a range of whole class teaching; individual or group in pairs combined with practical work (see Chapters 2 and 3 for the detailes). The new method involved the use of teachers' guides, record cards, wall charts (as shown in photographs 11 and 12) and equipment for practical work, as mentioned in the pilot trial.

(2) Teaching method for the control group

In the old 'traditional' method, as previously stated, it was customary for the teacher to explain to the whole class by using some examples from a normal textbook, sometimes writing on the blackboard. The children have no textbooks. They copy the example into their notebooks. The teacher gives the children homework and the following day she marks their notebooks - regardless of any difficulties experienced by children, the teacher then moves on to the next unit. The teachers of the control classes used this method to teach the pupils the same content of 'Fractions', 'Plants' and 'Magnetism'. The investigator gave the teachers identical content of these units, but without the

Photograph No.11 Wallchart for mathematics ('Fractions') unit, fifth grade.

Photograph No.12 Wallchart for science ('Plants') unit, fourth grade.

cartoons and questions in the science materials 'Plants and Magnetism' and without the cartoons in the mathematics material (see the following example and microfiche), to ensure that the pupils in the control group had the same knowledge. The same pre- and post-tests were used with both groups. In this way, the final comparison would be more accurate.

كيف تستجيب النباتات الى الضوء

النباتات تستجيب الى الضوء أكثر من اي الكائنات الحية. وذلك لان النباتات تحتاج الى اشعة الشمس لصنع الغذاء وبدون ضوء الشمس تموت.

في الغابات تنمو النباتات بشكل متشابك، فالاشجار تنمو الى الاعلى حتى تحصل على ضوء الشمس. هل انك شاهدت اشجار طويلة ومستقيمة في الغابة تشبه العمالقة وتحاول احداهما ان تصبح اطول من الاخرى، وانهم يتنافسون من اجل الحصول على ضوء الشمس. ان النباتات الصغيرة التي تنمو في ظل تلك الاشجار العالية لا تحصل على كمية من الضوء التي تحتاجه. ويؤدي هذا الى موتها في النهاية.

النباتات تمد الجذور الى الاسفل لتبحث عن الماء، وانها تمد سيقانها الى الاعلى لتحمل الاوراق بجانب الضوء. تتحرك هذه السيقان بجانب الضوء كما تتحرك الجذور بجانب الماء.

لا تستجيب سيقان النباتات فقط الى الضوء، ولكن ايضا هنالك بعض الازهار لها نفس الاستجابة. كوردة الصبح تتفتح في الصباح المشرق وتنام في الليل. وتتتبع زهرة عباد الشمس حركة الشمس في السماء من الشروق الى الغروب.

(3) Duration of the units 'Experimental and Control'

The experimental group started the three units at weekly intervals, to enable the observation of the same lessons in each school to take place more easily. The control group started roughly at the same time as the experimental group in school No.1, which was crucial to the time spent on the task. Table No.31 illustrates the number of weeks required to complete the units for the three grades at the six schools, provided that both experimental and control groups had the same number of lessons within the same period of time. Table No. 32 shows the number of lessons and the period by minutes of each lesson the pupils took in both experimental and control groups of mathematics and science in each week. The limited time shown in these tables bears out the inferences gained from the pilot trial (see Chapter 3).

Table No.31 Number of weeks

Grade	Mathematics	Science
4	6	6
5	6	6
6	5 + 4 days	5 + 4 days

Table No. 32 Summary of learning time for the mathematics and science units

Grade	Mathematics No. of min/ period	Mathematics No. of lessons weekly	Science No. of min/ period	Science No. of lessons weekly
4	40	6	50	6
5	40	6	50	6
6	50	6	40	3

(4) Evaluation strategy

The evaluation strategy was explained in detail for the pilot trial in Chapter 3. With regard to the field trial evaluation strategy, if educational innovations are to be effective agents, not only of change, but also of improved learning in schools, then evaluation 'does not take place on a single occasion at or towards the end of the period of implementation, but rather that it is related to all activities of planning, developing and implementing an innovation' (Nicholls, 1983, p.79). The evaluation process must be incorporated into the development stage of the new programme. The evaluation strategy of the new teaching strategy was a part of the pilot trial from the beginning.

The purposes of the field trial evaluation were mainly to follow the implementation process of the pilot trial in some schools for the hearing impaired. In addition, a comparison was to be made between the schools which used the new method (experimental group) and those using the old method (control group).

Additional questions to those posed in the pilot trial were asked in the field trial, for instance, did pupils learn the course content by using the new method when compared with the pupils using the old method? Did pupils' language improve when they used the new method as compared with that of pupils using the old method?

In order to answer these questions, a suitable evaluation style had to be chosen. As mentioned before, the strategy used in the evaluation of the pilot trial was of an illuminative style, with some quantitative and objective supporting informative roles. From this, it was found that there was an improvement in the pupils' language and so the evaluation style of the field trial was changed. The quantitative style formed the main core for the evaluation and the illuminative style gave support in summative and formative roles. These approaches suited the general objectives of the evaluation: an holistic study of the implementative process, when the new method was still in its developmental stage, as well as comparing the new and old method statistically, generally and specifically.

Methods of collecting information

In order to obtain information for course evaluation, a variety of approaches was used. The various methods were used with a view to obtaining a descriptive and comparative pictures of the course at the field trial. These included:

(i) pre- and post-tests (language and content)
(ii) observation
(iii) record card
(iv) informal interview with teachers and pupils

Table No. 33 shows the methods of collecting information from the experimental and control groups.

Table No. 33 Methods of collecting information from the two groups (experimental and control)

Methods / Grades	Pre- and post-tests for language	Pre- and post-tests for content	Observation	Record card	Interview with teachers and pupils
4	* *	* *	* x	*	*
5	* *	* *	* x	*	*
6	* *	* *	* x	*	*

Key: ** the two groups (experimental and control); * experimental group; *x experimental group and individual pupils in control group.

There were major changes to the criteria for evaluating the course. The language test was added to those tests used in evaluating the course in the pilot trial. A section of practical work was added to the observation checklist. The post-test (attainment tests for mathematics and science) were used as pre- and post-tests (details in Chapter 3).

(i) Pre- and post-tests

Details of these tests were presented in the pilot trial described in Chapter 3.

The tests listed below were administered with both groups in the study to ascertain what progress had been made by using different teaching strategy with the above groups (the new method with the experimental group and the old method with the control group) and to compare the results with the two whole groups, matched grades and matched pairs:

- Language test 'spoken and written'
- Attainment tests 'Mathematics and Science'

- The language test 'spoken and written'

This test was introduced in Chapter 4.

- Attainment tests 'Mathematics and Science'

The mathematics attainment test 'Fractions' unit, consisted of five questions for the fourth and fifth grades and six questions for the sixth grade (see Chapter 3 and Appendix No. 9). The tests for science 'Plants and Magnetism' units consisted of ten questions (see Appendix No.9).

Scoring for the tests was decided by the teachers and inspectors after discussion with the investigator together, as described in Chapter 3. This was done before the pilot trial. Once again, scoring of the tests was discussed with the teachers involved in the field trial. This showed agreement with the scoring for the pilot trial tests. The scoring for the mathematics and scinece tests is shown in Appendix No. 10.

- Validity of the attainment tests 'Mathematics and Science'

This was described in Chapter 3 (the pilot trial).

- Reliability of the attainment tests 'Mathematics and Science'

This term was explained in detail in Chapter 4. Briefly, the type of reliability used to obtain the reliability of these tests was internal consistency.

Results of the post-tests for all pupils in both groups were used to determine the reliability of the tests. The internal consistency was computed by the Alpha method. Coefficient alpha is given by the equation:

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\text{sum of variances of question scores}}{\text{variance of total test scores}}\right)$$

n = the number of questions in the test

(Bynner, 1981, p.66)

Tables 34 and 35 illustrate the reliability coefficient of the mathematics and science tests.

Table No. 34 The reliability of the mathematics test for the two groups

Grade	Alpha	DF
4	0.78	43
5	0.88	31
6	0.88	49

Table No. 35 The reliability of the science test for the two groups

Grade	Alpha	DF
4†		
5†	0.91	75
6	0.89	49

Actual scores for these tests are contained in the wallet with Appendix A.

†The two grades (4 and 5) had the same test in science.

The results of the tests show an acceptable level of reliability and in addition, correlation between scorers was obtained for these tests. This was done by giving the post-test examination papers of all the pupils in both groups to two other scorers to correct in addition to the teachers. The correlation of the three scorers was obtained by using the Pearson product-moment coefficient of correlation. The basic formula is:

$$r_{xy} = \frac{\Sigma XY}{NS_x S_y}$$ (Guilford and Fruchter, 1981, pp.81-82)

Details of this formula are presented in Appendix No. 19.

Tables Nos. 36-40 illustrate the results of each test.

Table No. 36 The correlation between the three scorers of the science test for the fourth and fifth grades

Scorers	Scorer 1	Scorer 2	Scorer 3
1	1.000		
2	0.998	1.000	
3	0.999	0.998	1.000

Table No. 37 The correlation between the three scorers of the science test for the sixth grade

Scorers	Scorer 1	Scorer 2	Scorer 3
1	1.000		
2	0.999	1.000	
3	0.999	0.999	1.000

Table No.38 The correlation between the three scorers of the mathematics test for the fourth grade

Scorers	Scorer 1	Scorer 2	Scorer 3
1	1.000		
2	0.999	1.000	
3	0.999	0.999	1.000

Table No.39 The correlation between the three scorers of the mathematics test for the fifth grade

Scorers	Scorer 1	Scorer 2	Scorer 3
1	1.000		
2	0.999	1.000	
3	0.999	0.999	1.000

Table No.40 The correlation between the three scorers of the mathematics test for the sixth grade

Scorers	Scorer 1	Scorer 2	Scorer 3
1	1.000		
2	0.999	1.000	
3	0.999	0.999	1.000

From the above tables, it would appear that there were high correlations between the three scorers, which means that there was agreement between the three scorers when they marked the papers for the above tests.

(ii) Observation

Another way to collect information for evaluating the course was by observing the pupils in the classroom (see Chapter 3 for the details). The checklist was designed consisting of five sections:

1. The pupil by him/herself
2. The pupil by his/her group
3. Practical work
4. Playing
5. Teacher talks to pupils

Each section was subdivided into categories. The total number of categories was fifteen (see Observations checklist). During observation at the end of each two minutes, the activity of pupils at this time was recorded as in the pilot trial.

- Validity of the observation checklist

As mentioned in the pilot trial, the content of the observation checklist did not measure what it was designed to measure until a section on practical work had been added. The checklist was discussed and agreed by the teachers in the experimental group before it was used in the field trial.

- Reliability of the observation checklist

The problem of reliability has already been discussed (see Chapter 3, the pilot trial).

(iii) Record card

There was a record card for each pupil in each unit, as in the pilot trial (see Chapter 3).

Observation Checklist

Date:________ Start time:________

Make a tally (/) in the appropriate box if the behaviour occurs in the previous two minutes.

Class:________

Minutes Behaviour observed	2 4 6 8 10 12 14 16 18 20 22 24 --------------
1. The pupil by him/herself (1) Searching the materials (2) reading the materials (3) Writing - 2. The pupil with his/her group (4) Talking to another pupil (5) Talking to the group (6) Listening to another pupil (7) Listening to the group 3. Practical work - (8) Doing some practical work alone (9) Doing some practical work with a friend (10) Doing some practical work with the help of the teacher (11) Doing some practical work with the help of a friend 4. Playing - (12) Behaviours and activities not related to the task 5. Teacher talks to pupils (13) At pupil's request (14) Without a request from the pupil (15) By giving an announcement, talk, explaining to the whole group/class	

(iv) Informal interviews with teachers and pupils

This was also described in Chapter 3 (the pilot trial). This chapter presented the course and the methods which were used with the two groups to evaluate the course.

The results and their analyses and discussion of the above methods will be presented in the next chapter,

CHAPTER SEVEN: RESULTS OF THE FIELD TRIAL

CHAPTER 7

RESULTS OF THE FIELD TRIAL

This chapter includes an analysis and discussion of results for the methods which were used to gather information about the course with the two groups (control and experimental) detailed in Chapter 6. Briefly, the methods used were:

- pre- and post-tests including
  Language test 'spoken and written'
  Attainment test 'Mathematics and Science'
- observation
- record card
- interviews with teachers and pupils

1. Analysis of the Results

The difference between pre- and post-test raw scores is so striking that further statistical analysis was unnecessary. However, the data were analysed using parametirc and non-parametric techniques to ascertain how statistically significant the differences are. In particular, we were interested in the extent to which pupils' language and knowledge improved. The t-test was used to test the significance of the difference between pre-and post-tests using the following formula:

$$*t = \frac{M_2 - M_1}{\hat{\sigma}_D} \qquad \text{(Lewis, 1967, p.120-121)}$$

(see Appendix No. 20 for details).

$^*M_1$ = mean of pre-test
M_2 = mean of post-test
$\hat{\sigma}_D$ = estimated standard error

Having obtained a value for 't', this was referred to a table of significant level for the t ratio at 0.01 level. If the value of 't' failed to reach the critical value at 0.01, then non-statistically significant difference would be accepted.

The non-parametric Mann-Whitney U test of differences in rank was used to analyse the data from the experimental and control groups on pre- and post-test. The formula which was used is shown below:

$$U_i = N_a N_b + \frac{N_i(N_i + 1)}{2} - R_i$$

(Guilford and Fruchter, 1981, p.219)

The value of U is converted for a sample of this size to a z score and referred to a table showing significance levels. The scores are listed in the wallet with Appendix B.

(i) Results of pre- and post-tests

In the previous chapters it was stated that language and knowledge within the two groups were tested before starting the course as pre-tests and again at the end of the course, as post-tests.

To ascertain the information detailed in Chapter 5, the following analysis was required. However, the matched pairs will be presented in a different section in this chapter.

I First statement:

To find if there was a significant difference between whole control and experimental groups at pre-tests (Language 'spoken and written' and Attainment 'Mathematics and Science') and if there were

<u>significant differences between the same two groups at post-tests for the same tests.</u>

The Mann-Whitney U test was used to ascertain the results of these tests. The results were obtained with the aid of computer analysis. There is a statistical significant difference if the probability value is equal to, or less than $\alpha = 0.01$.

- <u>Results of spoken language test</u>: Table No. 41 shows the results of the spoken language pre-test.

Table No. 41 Values of probability derived from M-W test applied to differences between the two groups in the spoken pre-test

TW	TS	WPS	SQ	AC
0.26	0.39	0.03	0.86	0.09

These results revealed that there were no significant statistical differences between the two groups on the spoken pre-test at level 0.01. However, the results of the post-test of the two groups as shown in the following table were highly significant at level 0.01, with the exception of words per sentence (WPS).

Table No. 42 Values of probability derived from M-W test applied to differences between the two groups in the spoken post-test

TW	TS	WPS	SQ	AC
0.00	0.00	0.75	0.00	0.00

From the above, the investigator inferred that all the pupils at the three grades in the six schools were at the same level in spoken language before they commenced the course, but there was a difference at the end of the course.

- Results of the written language test

All the results of the written language test of the two groups together were not significant at level 0.01. Table No. 43 illustrates this point.

Table No. 43 Values of probability derived from M-W test applied to differences between the two groups in the written language pre-test

TW	TS	WPS	SQ	AC
0.99	0.79	0.63	0.67	0.95

Table No. 44 shows the results of the written language post-test for the two groups together, and reveals that the results were highly significant at level 0.01.

Table No. 44 Values of probability derived from M-W test applied to differences between the two groups in the written language post-test

TW	TS	WPS	SQ	AC
0.00	0.00	0.00	0.00	0.00

- Results of the mathematics attainment test

The mathematics attainment pre-test showed a probability of 0.00, this is (below 0.01 and) is significant. The raw scores for each of the pupils in the two groups is given in Appendix No. 21 . It was found that the pupils in the control group did better in the pre-test than pupils in the experimental group. However, in the post-test, the results were significant at level 0.01 (0.00), with the experimental group doing better than the control group.

- Results of the science attainment test

The science attainment pre-test showed a probability of 1.00,this is above 0.01 and is not significant . This means that the pupils in the two groups had the same level of knowledge in science at the pre-test, but they achieved different scores in the post-test and the result was statistically significant at level 0.01 (0.00) with the experimental group gaining much better scores than the control group.

II Second statement

To find if there was any significant difference between mean scores of pre- and post-tests for the same level of grades 4, 5 and 6 in the two groups (control and experiment) using the t-test technique.

All the mean scores of all the pre- and post-tests for the two groups were presented in Appendix No.22.

- Results of the spoken language test

All t-test results of the three grades of the control group were not significant at level 0.01, as shown in Table No.45.

In the experimental group, all the aspects of the test were significant at level 0.01 for the three grades, except words per sentence, which was not significant at level 0.01 for the fourth and sixth grades (see Table No. 46).

Table No. 45 The t-test results of the spoken test for the control group by grades

Grade	TW	TS	WPS	SQ	AC	dF
4	1.26	1.50	0.58	1.04	zero	21
5	2.54	0.29	0.54	1.67	0.35	15
6	0.78	0.13	0.16	1,12	zero	24

Table No. 46 The t-test results of the spoken test for the experimental group by grades

Grade	TW	TS	WPS	SQ	AC	dF
4	12.24	7.81	0.11	12,08	14.41	21
5	17.77	6.58	3.40	14.86	7.05	15
6	13.33	10.00	1.82	4.42	9.22	24

- Results of the written language test

Table No. 47 shows the t-test results of the three grades of the control group and these reveal that all of them are not significant at level 0.01, with the exception of the total words (TW), syntax quotient (SQ) and abstract-concrete (AC) for the sixth grade. However, when compared to the mean scores in the discussion sections, it can readily be seen that the mean ($\bar{x}$) of the pre-test on the above aspects was higher than the mean ($\bar{x}$) of the same group at post-test; [($\bar{x}$) of TW in the pre-test is 25.71, and in the post-test is 19.64, that of SQ in the pre-test is 63,90 and in the post-test 56.04, the $\bar{x}$ of AC in the pre-test is 7.23 and in the post-test is 5.02]. This means that the pupils did not gain scores in the post test, but deteriorated in some aspects. There was therefore no progression and the results are significant in their deterioration.

Table No.47 The t-test results of the three grades of the control group in the written test

Grade	TW	TS	WPS	SQ	AC	dF
4	0.71	0.86	0.48	0.25	1.57	21
5	0.44	1.06	0.39	1.30	0.85	15
6	3.18	2.36	0.21	3.36	3.48	24

All the t-test results in the written test for the three grades of the experimental group, however, were significant at level 0.01, as shown in Table No. 48.

Table No. 48 The t-test results of the three grades of the experimental group in the written test

Grade	TW	TS	WPS	SQ	AC	dF
4	18.89	10.67	6.78	14.46	4.75	21
5	11.22	6.24	4.78	8.05	8.09	15
6	7.70	3.60	7.15	7.40	9.90	24

- Results of the mathematics attainment test

The results of the t-test of the mathematics for the three grades of the control group are shown in Table No. 49. The results of grades 4 and 6 were not significant at level 0.01, but the results of the fifth grade were significant at level 0.01. Hence, the pre-test mean ($\bar{x}$) score (55.00) was higher than the post-test ($\bar{x}$) score (42.5) as in the written test. Most of the pupils had lower scores in the post-test, rather than gains. Therefore, it could be said that these results confirm that the pupils in the control group performed badly.

Table No. 49 The t-test results of mathematics for the three grades of the control group

Grade	Mathematics test	dF
4	2.64	21
5	3.87	15
6	0.78	24

However, the results of the t-test for all the grades in the experimental group were significant at level 0.01, as shown in the following table:

Table No. 50 The t-test results of mathematics for the three grades of the experimental group

Grade	Mathematics test	dF
4	13.30	21
5	13.33	15
6	27.37	24

- Results of the science attainment test

Tables Nos. 51 and 52 illustrate the t-test results of science for the three grades of the control group and of the experimental group. The figures reveal that the results were significant at level 0.01. This is because the pre-test mean scores ($\bar{x}$) of each grade of the two groups is zero. Nevertheless, the three grades in the experimental group still gained higher results than those of the control group. For example, grade 4 of the experimental group gained six times more than grade 4 of the control group and so on.

Table No. 51 The t-test results of science for the three grades of the control group

Grade	Science test	dF
4	11.10	21
5	12.08	15
6	18.79	24

Table No. 52 The t-test results of science for the three grades of the experimental group

Grade	Science test	dF
4	66.86	21
5	60.51	15
6	69.03	24

III Third statement:

To find if there were any significant differences between mean scores of pre- and post-tests for matched grades by using the t-test technique

Matched grades were previously described in Chapter 5, but briefly:

Grades 4, 5 and 6 (School No.1, experimental) matched with:
Grades 4, 5 and 6 (School No.6, control)

Grade 4 (School No.2, experimental) matched with:
Grade 4 (School No.4, control)

Grades 5 and 6 (School No.2, experimental) matched with:
Grades 5 and 6 (School No.5, control)

Grade 4 (School No.3, experimental) matched with:
Grade 4 (School No.5, control)

Grades 5 and 6 (School No.3, experimental) matched with:
Grades 5 and 6 (School No.4, control)

All the mean scores ($\bar{x}$) of the above matched grades of all the pre- and post-tests are presented in Appendix No.23.

- <u>Results of the spoken language test</u>

The t-test results of the spoken language test for the matched grades of the fourth grade were illustrated in Table No.53. This table shows that all the results for the control schools (4, 5 and 6) were not significant at level 0.01, but all the results of the experimental schools (1, 2 and 3) were significant at level 0.01, with the exception of WPS.

The results of the t-test of the matched grades (fifth grade) manifest that all fifth grades at the experimental schools had significant differences at level 0.01 in total words (TW) and syntax quotient (SQ) and all the grade fives in the experimental schools obtained non significant differences at level 0.01 in words per sentences (WPS). However, the above grade at school No.1 obtained non significant differences at level 0.01 in abstract-concrete (AC), school No.2 obtained non significant differences at level 0.01 in total sentences. Yet all of the matching grades in the control schools (4, 5 and 6) had non significant differences at level 0.01 at all the aspects of the language test (see Table No.54).

The results of the matched grades at the sixth grade reveal that there were non significant differences at all the aspects of the spoken language test at level 0.01 at the control schools (4, 5 and 6). However, the matching grades in the experimental schools (1, 2 and 3) obtained the following results. Matching grades in School No.1 had significant differences in all the aspects of the test at level 0.01. Matbhing grades in School No.2 had non significant differences in total sentences (TS) and words per sentence (WPS) at level 0.01. Matching grades at School No.3 had non significant differences in WPS at level 0.01. Table No.55 illustrates this.

Table No. 53 The results of the t-test of the matched groups of the fourth grade (spoken language test)

Schools	TW	TS	WPS	SQ	AC	dF
1	10.97	4.56	0.04	10.35	7.00	6
6	0.88	zero	1.23	0.40	0.58	
2	6.09	4.43	0.90	5.66	9.71	7
4	2.59	zero	0.31	0.43	0.96	
3	9.86	4.83	2.04	8.63	9.07	6
5	0.19	2.04	1.40	2.34	zero	

Table No. 54 The results of the t-test of the matched groups for the fifth grade (spoken language test)

Schools	TW	TS	WPS	SQ	AC	dF
1	9.84	7.67	1.74	6.75	5.00	3
6	2.60	zero	0.04	0.66	zero	
2	10.77	2.71	3.77	13.29	6.93	5
5	0.60	zero	0.22	0.86	0.17	
3	12.04	4.39	1.73	6.83	5.31	5
4	1.75	zero	0.47	1.21	zero	

Table No. 55 The results of the t-test of the matched groups for the sixth grade (spoken language test)

Schools	TW	TS	WPS	SQ	AC	dF
1	13.14	7.84	5.39	7.04	5.81	9
6	1.25	1.01	0.38	0.77	0.56	
2	4.20	3.03	0.78	6.78	6.32	5
5	1.19	1.00	1.00	1.79	0.54	
3	12.59	11.09	1.16	5.42	8.22	8
4	0.43	0.71	0.65	0.27	zero	

- Results of the written language test

All the t-test results reveal (Tables Nos.56-58) that matching grades in the control schools obtained non-significant differences at level 0.01, except the total words (TW) of the fourth grade at School No.6, which were significant at level 0.01. However, if one looks back to the mean, it can be seen that the pre-test mean score ($\bar{x}$) was higher than the post-test mean score ($\bar{x}$). This means that the pupils did less well in the post-test, rather than gaining more marks.

With the matching grade in the experimental schools (1, 2 and 3) however, there is a significant difference at level 0,01 in most of the aspects of the written language tests, Hence School No.1 obtained non significant differences at level 0.01 in abstract-concrete at fourth and fifth grades. Grade six in the same school had non significant differences in total sentences and words per sentence. Grade 5 at School No.2 had non significant differences at level 0.01 in words per sentence and grade six in the same school obtained non significant differences at the same level in total sentences and words per sentence and also in syntax quotient. School No.3, grade 4, obtained non significant differences in words per sentence, However, grade five in the same school obtained non significant differences at level 0.01 in total words and words per sentence and grade six had non significant differences at the same level in total words.

- Results of the mathematics attainment test

All grades at the control schools got non significant difference results at level 0.01, as shown in Tables Nos.59-61, except grade five at School No.4. Yet the mean score ($\bar{x}$) of the pre-test for the above grade got higher scores ($\bar{x}$ = 53.33) than their mean score of the post-test ($\bar{x}$ = 37.35). This means, as mentioned before, that the pupils did

Table No. 56 The results of the t-test of the matched groups of the fourth grade (written language test)

School	TW	TS	WPS	SQ	AC	dF
1	12.05	8.20	8.72	10.15	3.24	6
6	0.37	1.44	0.13	0.58	3.80	
2	8.62	4.73	6.20	10.14	5.51	7
4	1.28	0.24	0.35	1.35	1.22	
3	8.98	7.05	1.73	6.36	7.43	6
5	1.10	3.36	0.23	2.42	1.43	

Table No. 57 The results of the t-test of the matched groups of the fifth grade (written language test)

School	TW	TS	WPS	SQ	AC	dF
1	14.03	6.73	3.04	6.57	4.96	3
6	1.32	1.67	0.61	0.53	1.41	
2	5.34	10.33	3.17	6.06	5.72	5
5	0.44	0.41	0.62	1.04	0.77	
3	5.95	2.70	2.38	3.52	3.64	5
4	1.22	0 00	0.20	4.32	1.93	

Table No. 58 The results of the t-test of the matched groups of the sixth grade (written language test)

School	TW	TS	WPS	SQ	AC	dF
1	7.87	1.96	2.71	6.45	6.54	9
6	0.81	1.26	1.85	0.71	3.04	
2	6.21	1.38	2.17	3.91	6.32	5
5	2.37	0.54	0.50	0.69	1.86	
3	2.82	4.47	4.78	3.38	9.04	8
4	3.72	2.02	0.45	5.47	3.02	

not gain any marks in the post-test.

However, the t-test results of all the experimental schools were significant at level 0.01, as shown in the following tables:

Table No.59 The t-test results for the matched grades of the fourth grade at mathematics

School	Mathematics test	dF
1	11,97	6
6	1.11	
2	7.04	7
4	1.76	
3	6.32	6
5	3.15	

Table No.60 The t-test results for the matched grades of the fifth grade at mathematics

School	Mathematics test	dF
1	6.79	3
6	zero	
2	12.65	5
5	2.78	
3	6.94	5
4	4.20	

Table No.61 The t-test results for the matched grades of the sixth grade at mathematics

School	Mathematics test	dF
1	16.56	9
6	0.35	
2	43,38	5
5	1.21	
3	16.86	8
4	0.84	

- Results of the science attainment test

All the t-test results of this test for the grades at the experimental schools were significant at level 0.01 (see Tables Nos.62-64). All sixth grades at the control schools obtained significant results at level 0.01, as shown in Table No,64. However, grade five at School No.4 was the only grade to obtain significant results at level 0.01 (see Table No. 63).

Table No.62 The t-test results for the matched grades of the fourth grade at the science attainment test

School	Science test	dF
1	43.95	6
6	8.09	
2	39.88	7
4	5.20	
3	30.84	6
5	2.45	

Table No. 63 The t-test results for the matched grades of the fifth grade at the science attainment test

School	Science test	dF
1	27.27	3
6	1.73	
2	59.58	5
5	2.51	
3	30.20	5
4	7.55	

Table No. 64 The t-test results for the matched grades of the sixth grade at the science attainment test

School	Science test	dF
1	34.43	9
6	13.44	
2	90.63	5
5	9.80	
3	44.80	8
4	10.20	

Grade four at Schools Nos. 6 and 4 obtained significant results also (see Table No. 62). These control schools obtained significant differences in the science test, because, as has been mentioned previously, all the pupils in the two groups got zero in the pre-tests. However, the experimental schools still obtained higher results than the control schools.

(ii) Results and discussion of observation

As previously mentioned, the aim of using observation was to find out what actually happened in the classroom while the learning materials were being used.

The checklist (see page 146) was designed to record the observation of pupils.

The experimental shcools started the three units at weekly intervals to allow the investigator to observe the same lessons in sequence with each school. Two pupils were selected and observed at each lesson. In the 'Plants' and 'Fractions' units, over the course of a week, all the pupils in the classes (two pupils per lesson) were observed. However, in the 'Magnetism' unit, the observation of all pupils in the class took more than a week at Schools Nos. 1 and 3, because there were only three science lessons per week (School No.1 having 10 pupils and School No.3, 9). During observation, at the end of each two minutes, the activity of pupils was recorded. The length of the lesson was different for mathematics and science and differed from grade to grade as shown in Table No. 32, on page .

Each pupil was observed twice in mathematics and twice in science. The observation took place during the first and last weeks of the course with regard to the two schools mentioned above (Nos.1 and 3).

The method of analysing the observation data was to add all the minutes for one category for all the pupils in the same grade at the three schools, then ascertain the mean ($\bar{x}$) minutes for this category, These means ($\bar{x}$) for the fifteen categories of the three grades at the schools are displayed in Figures Nos. 6-17 (see Appendix No.24). Figure 6 shows the first observation of the mathematics lessons for the fourth grade at the three schools, and Figure 7 illustrates the second observation of the mathematics lesson for the fourth grade at the three schools. Comparing the first and second observations, for Section 1 the pupils gave more time to reading on the second observation than on the first and the pupils controlled themselves. They appear to be acquiring better knowledge of the language.

In Section 2, talking to one pupil or to the group was related to the questions on the worksheet. The pupils on the course showed some communication with the group, as well as with another pupil, from the first observation to the second. The time spent on talking and listening was not very different, as had been the case in the first observation, and it may be that the pupils learnt from listening to each other's new experience, as well as learning from talking.

Section No.3 - the time spent in categories 8 and 9 increased or decreased, depending on the questions in the worksheets. In category No.10, where the teacher helps the pupil to do his practical work, the time increased, because the teacher started to become familiar with her role in the new method. This indicated that the contacts between the teacher and the pupils increased, because they worked together.

Section No.4 - this section included the pupils' behaviour not related to the task. This differs from grade to grade and from lesson to lesson. It related to what happened before the lesson and during the lesson. For example, the pupils argued for no apparent reason sometimes, or they talked about what they saw last night on the

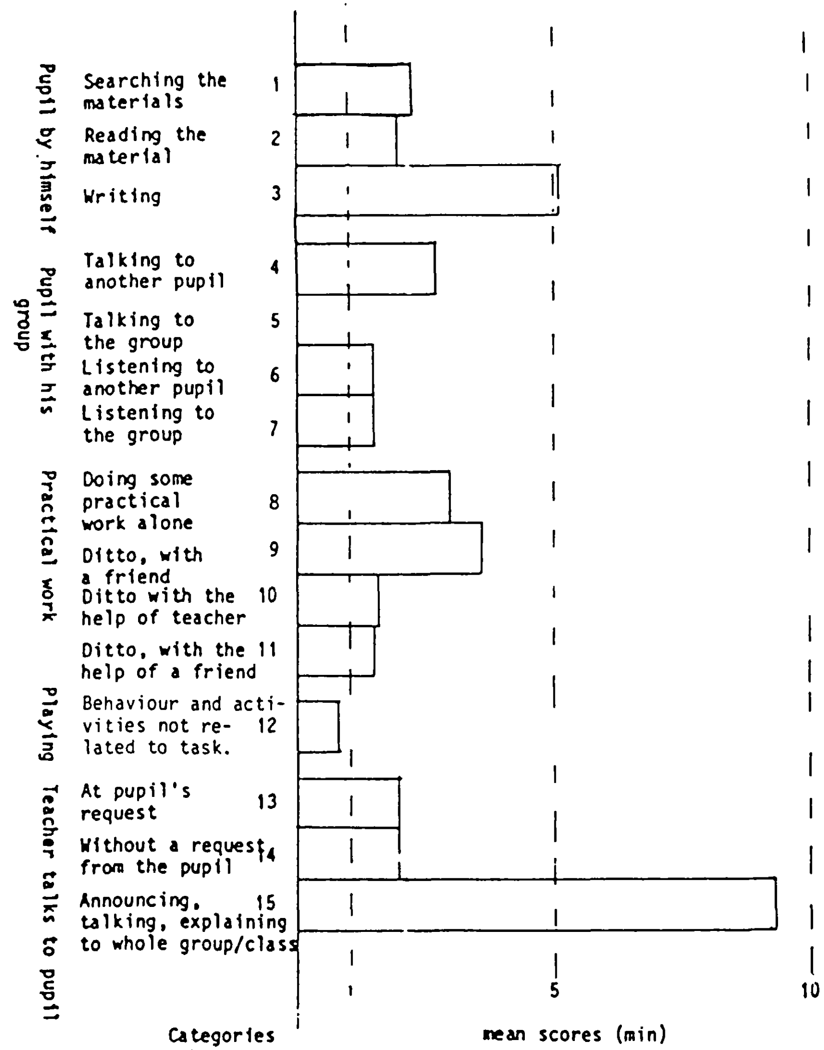


Figure No. 6 Mean scores of 22 4th grade pupils in 3 Schools
First observation of 40 minutes mathematics lesson

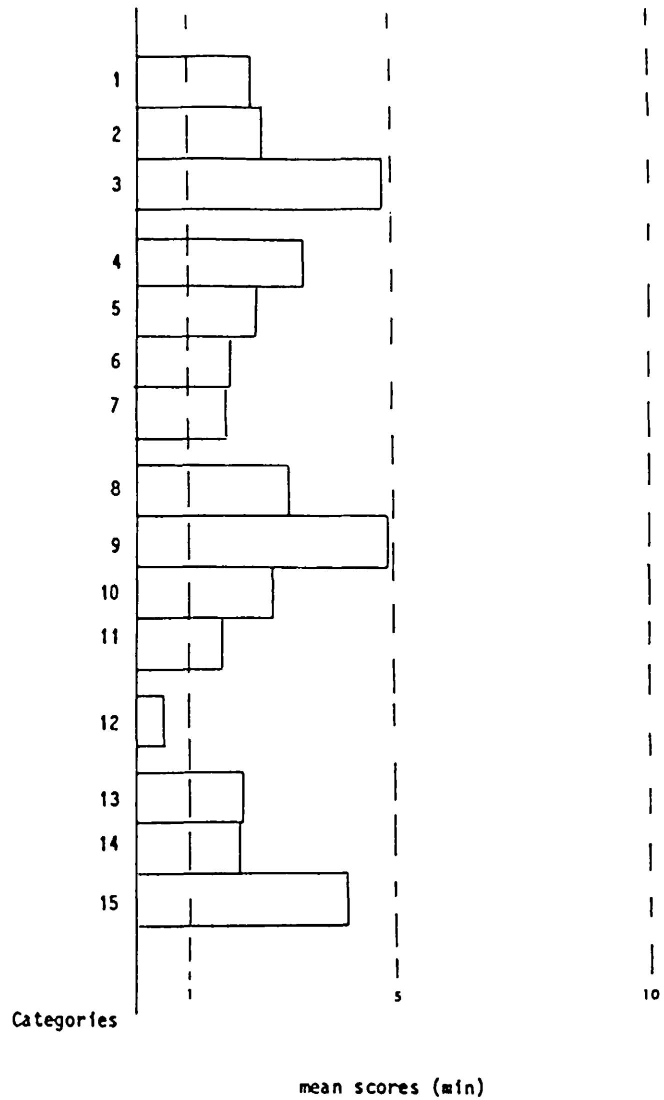


Figure No. 7 Mean scores of 22 4th grade pupils in 3 Schools
Second observation of 40 minutes mathematics lesson

television.... This category seemed to the investigator to be useful, because it encouraged the pupils to speak together. However, the pupils spent little time on this activity, because they were fully occupied by their work. This gave a good indication that they enjoyed the work and had positive reactions to this unit.

Section No.5 - category No.15 decreased considerably, because teachers mastered the new rules of controlling the classroom. Besides which, the pupils did not need a long time for the teacher to explain the lesson, since their language had improved, they could read the material, and they could understand what the material required much better than during the first observation.

The decrease in the time taken for this category gave the teacher more time to help the pupils individually and as a group.

The results of the observation for the fifth and sixth grades were similar to those of the fourth grade. An analysis was carried out of pupils who were observed in the same lesson at the first and second observation in mathematics and science at each grade in the three schools, and is illustrated in Figures Nos.18-29. It would seem that there was a difference between the first and second observations in both subjects (mathematics and science) for the six pupils in the same grade, but different schools. However, the difference between the two observations in both these subjects was the same for all pupils in these grades at the three schools.

The pupils engaged in different activities in these two subjects and they had more opportunities for working with one another, discussing, reading, writing and doing practical work, *etc*. Most of the above

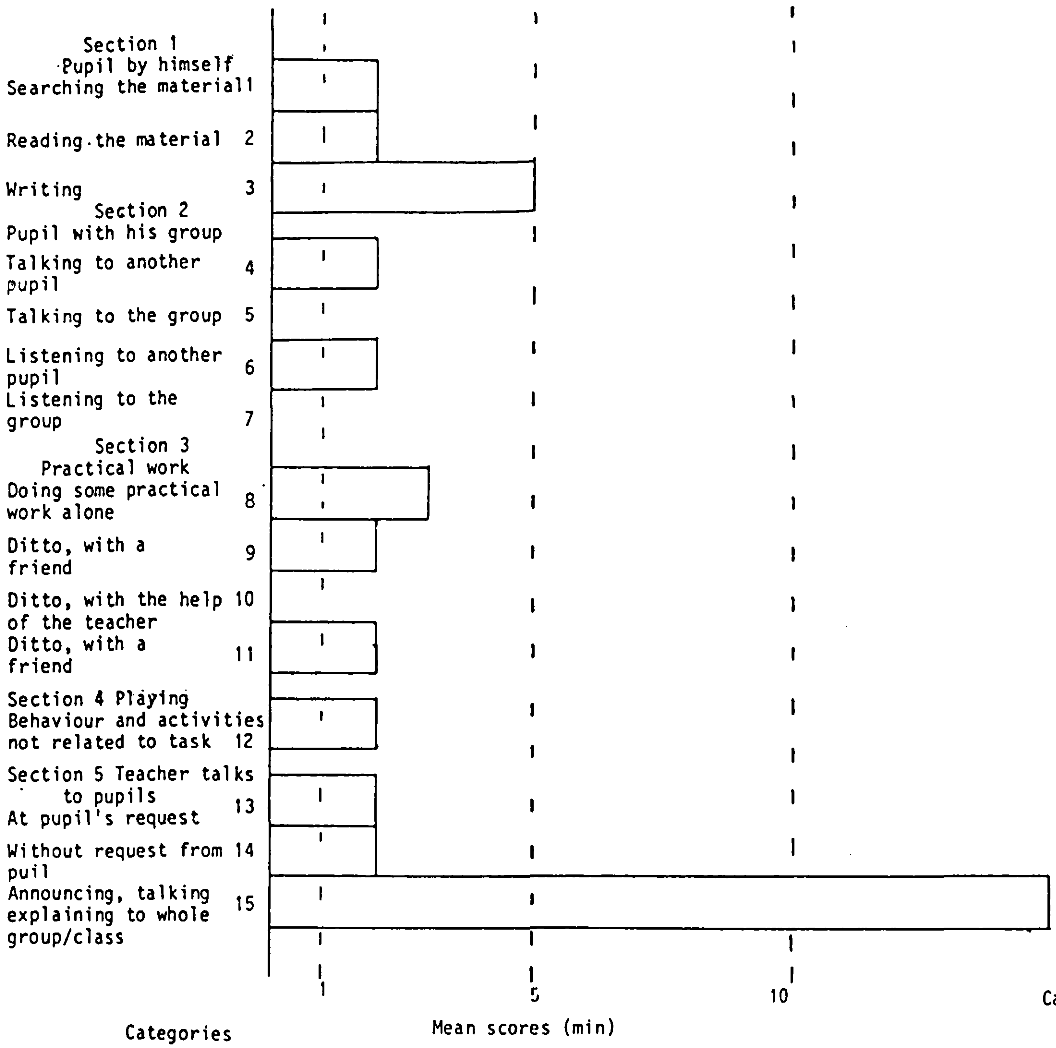


Figure No. 18 Mean scores of 6 4th grade pupils in 3 schools
First observation of 40 minutes in the mathematics lesson

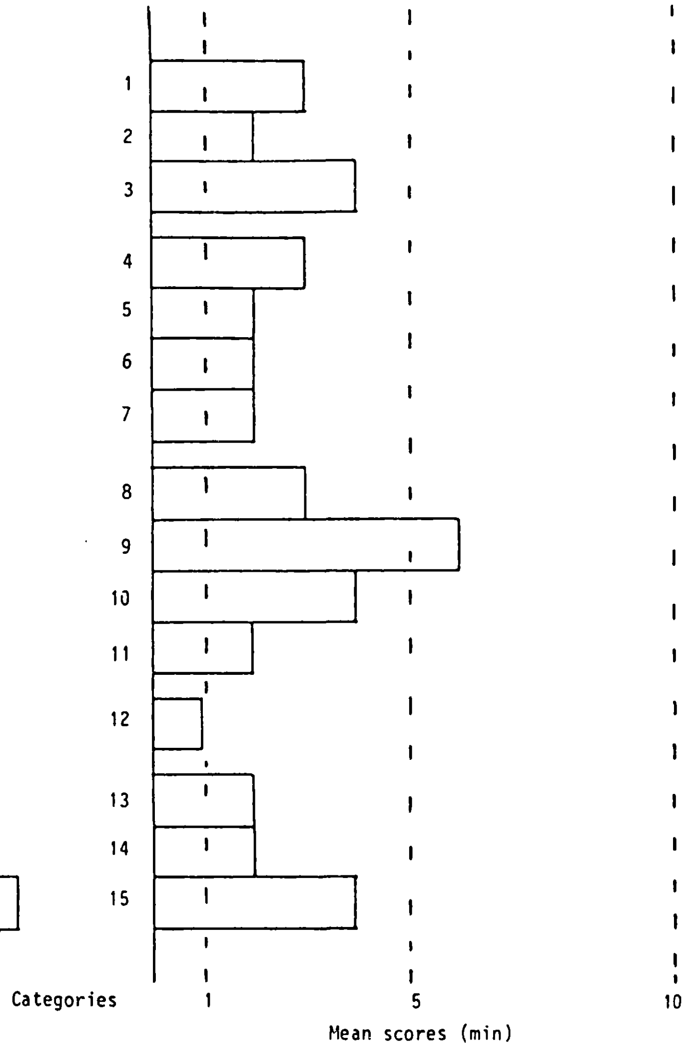


Figure No. 19 Mean scores of 6 4th grade pupils in 3 schools
Second observation of 40 minutes in the mathematics lesson

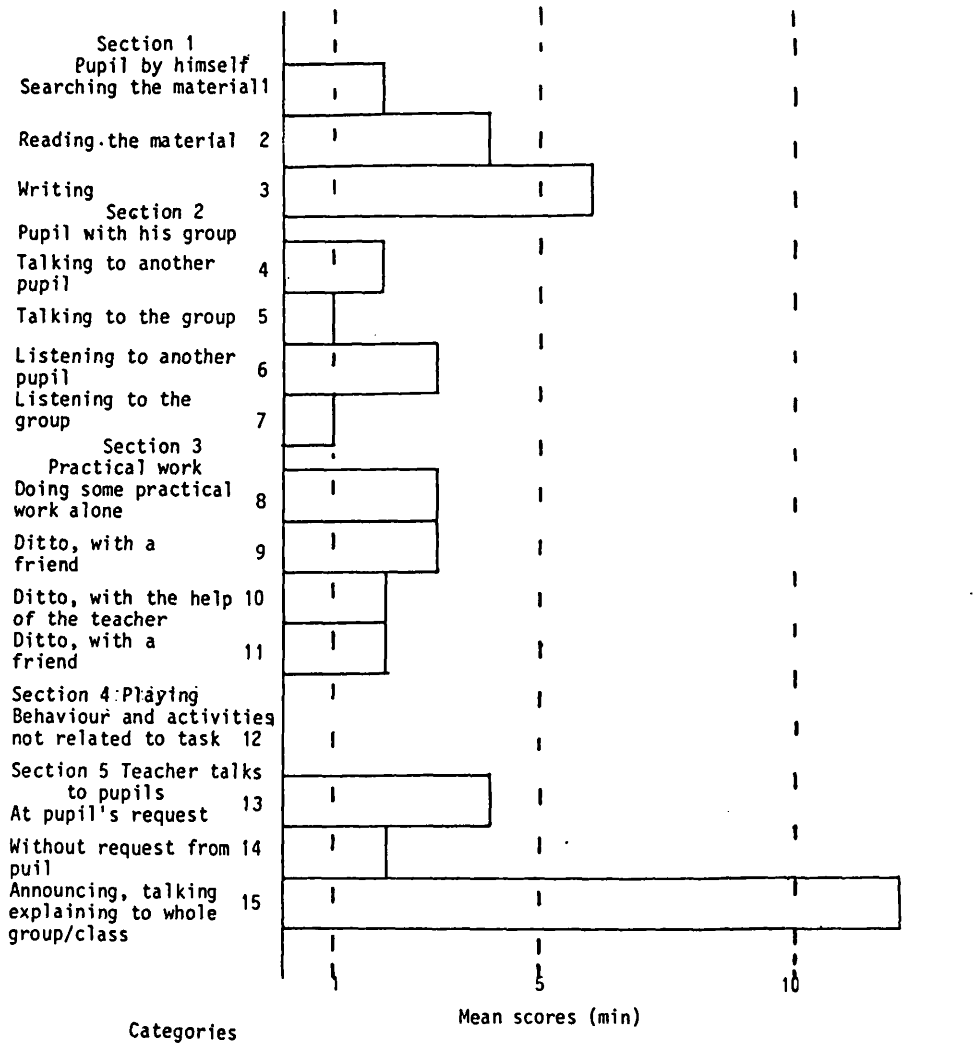


Figure No.20 Mean scores of 6 4th grade pupils in 3 schools
First observation of 50 minutes in the science lesson

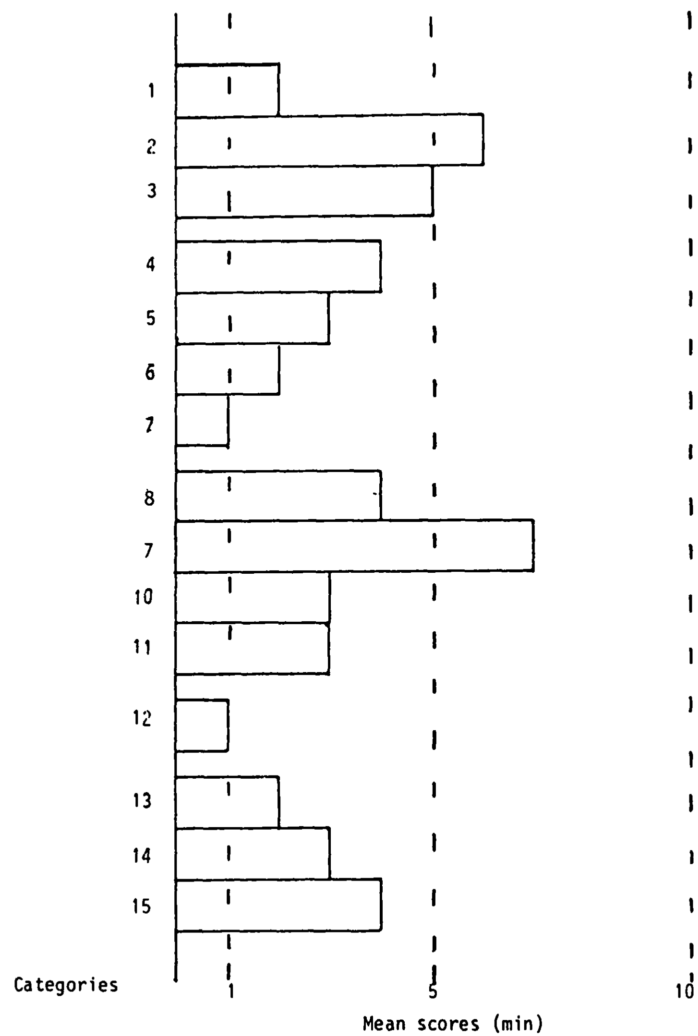


Figure No.21 Mean scores of 6 4th grade pupils in 3 schools
Second observation of 50 minutes in the science lesson

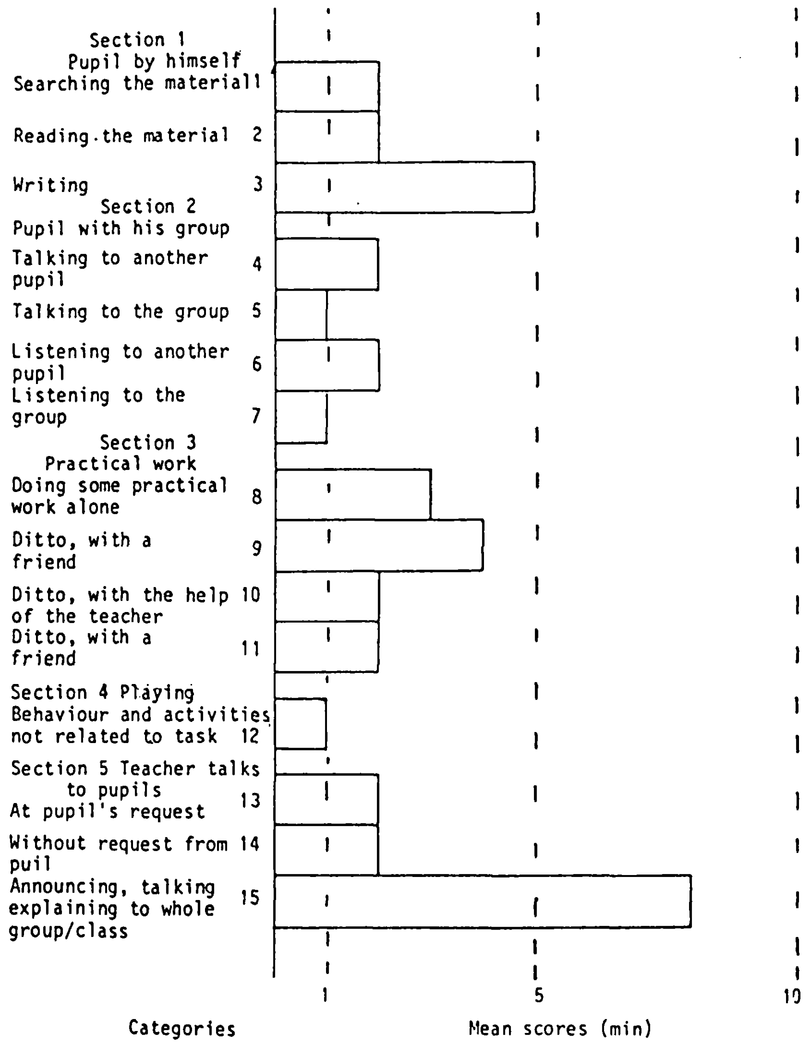


Figure No.22 Mean scores of 6 5th grade pupils in 3 schools

First observation of 40 minutes in the mathematics lesson.

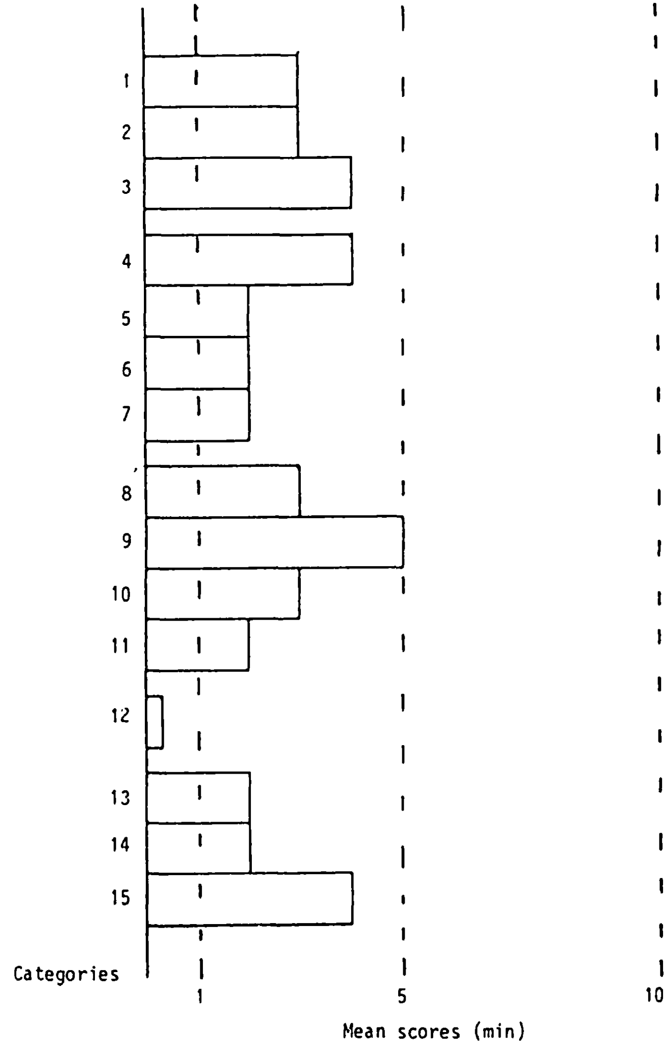


Figure No.23 Mean scores of 6 5th grade pupils in 3 schools

Second observation of 40 minutes in the mathematics lesson.

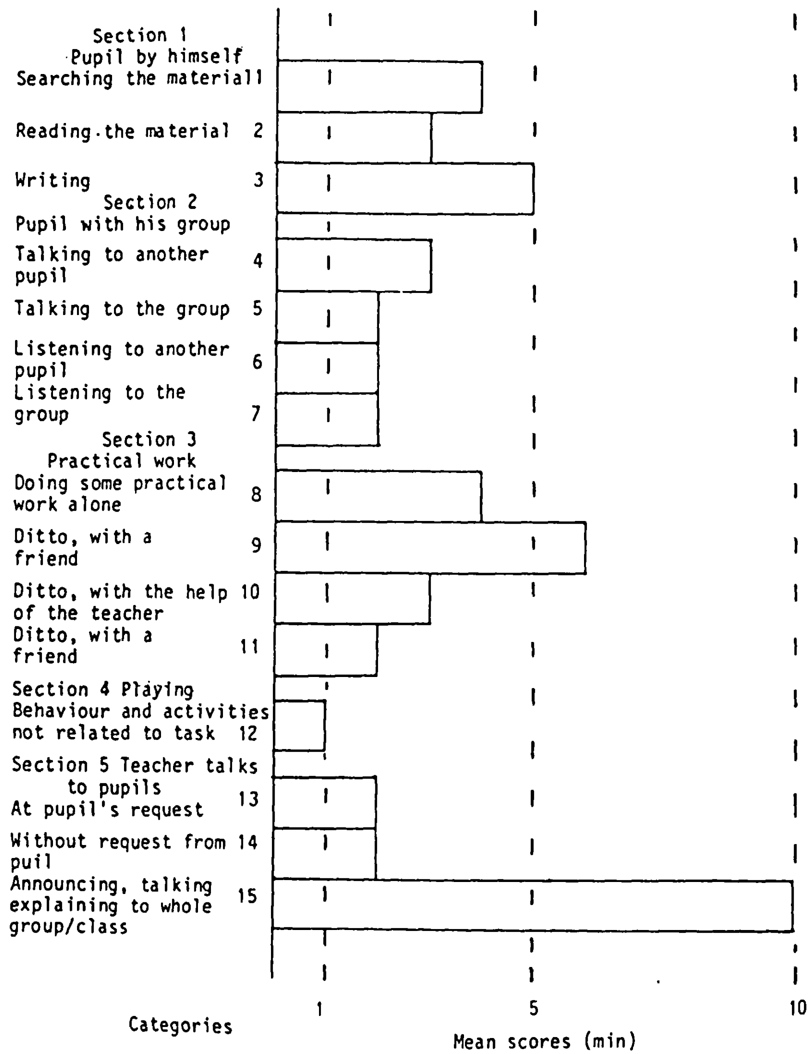


Figure No.24 Mean scores of 6 5th grade pupils in 3 schools
First observation of 50 minutes in the science lesson

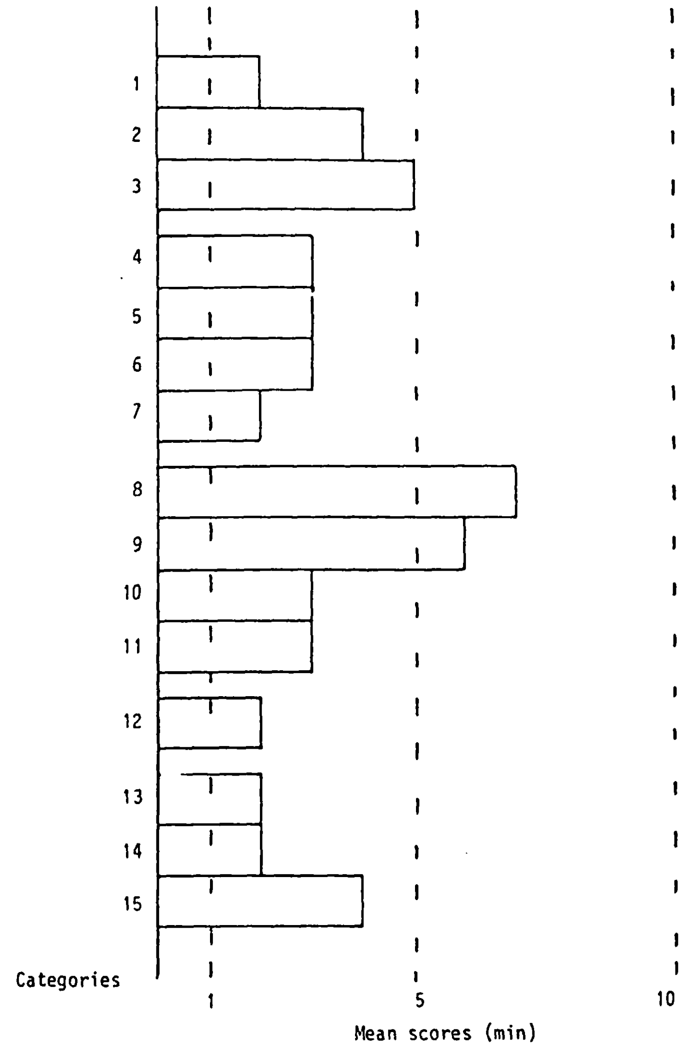


Figure No.25 Mean scores of 6 5th grade pupils in 3 schools
Second observation of 50 minutes in the science lesson

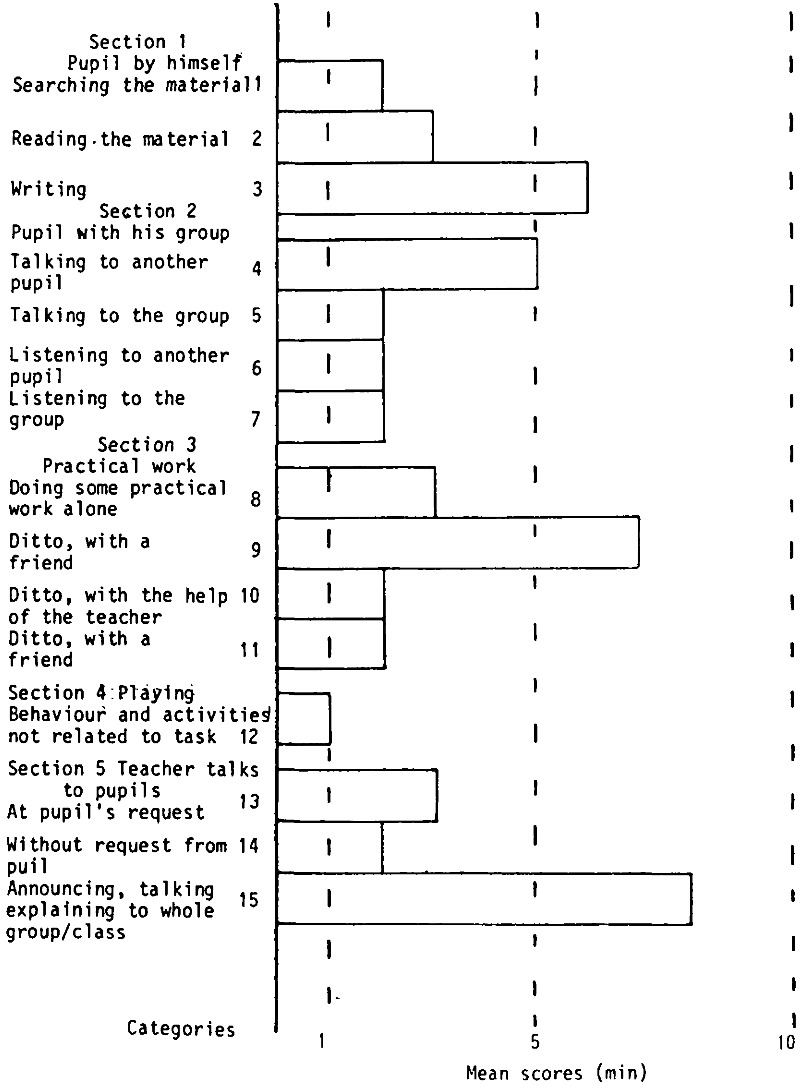


Figure No. 26 Mean scores of 6 6th grade pupils in 3 schools
First observation of 50 minutes in the mathematics lesson

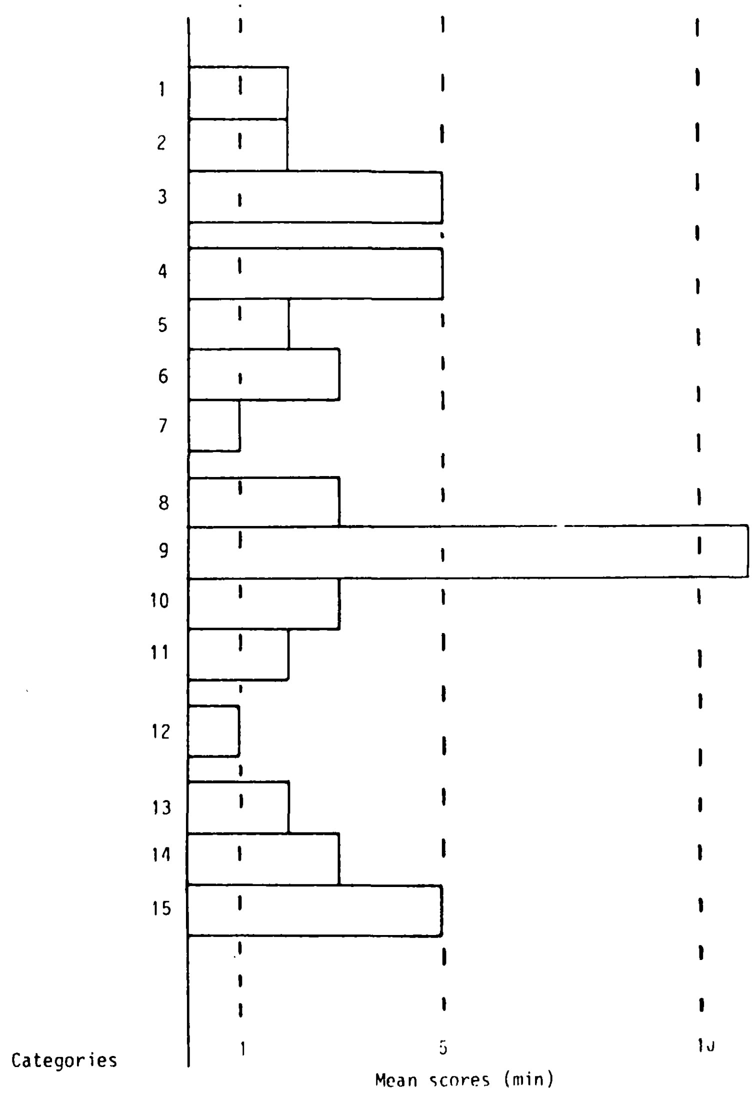


Figure No 27 Mean scores of 6 6th grade pupils in 3 schools
Second observation of 50 minutes in the mathematics lesson

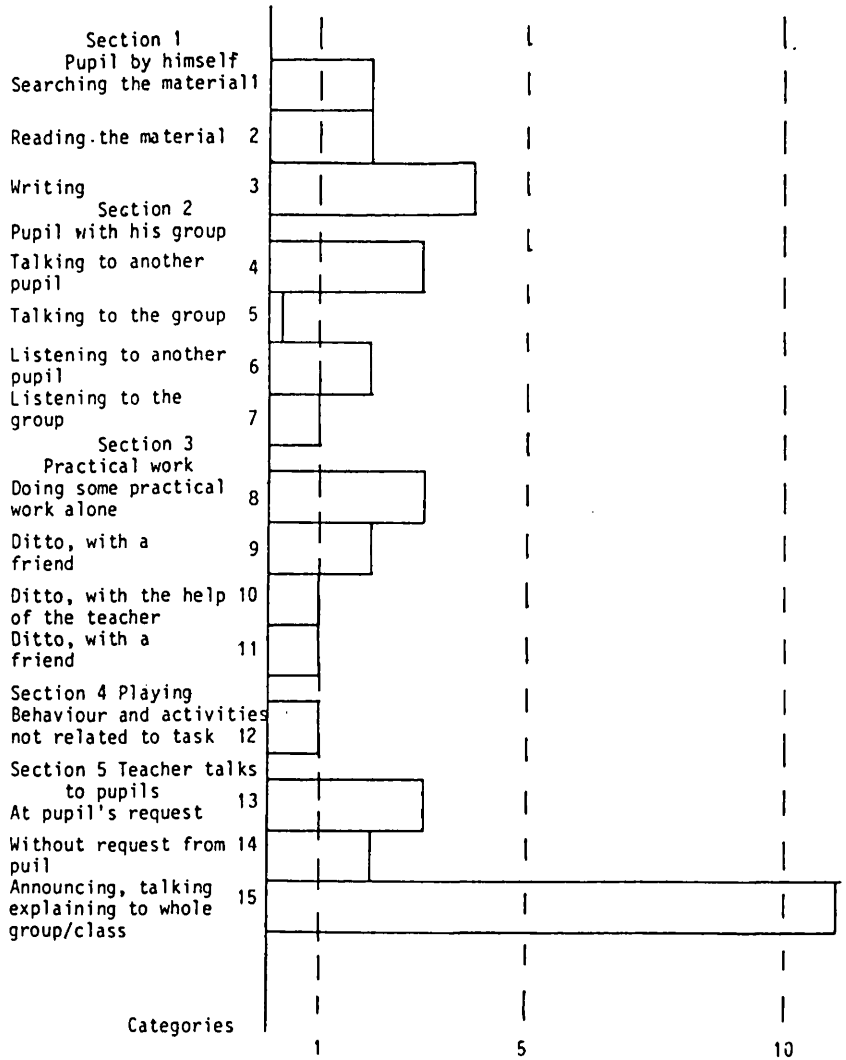


Figure No.28 Mean scores of 6 6th grade pupils in 3 school
First observation of 40 minutes in the science lesson

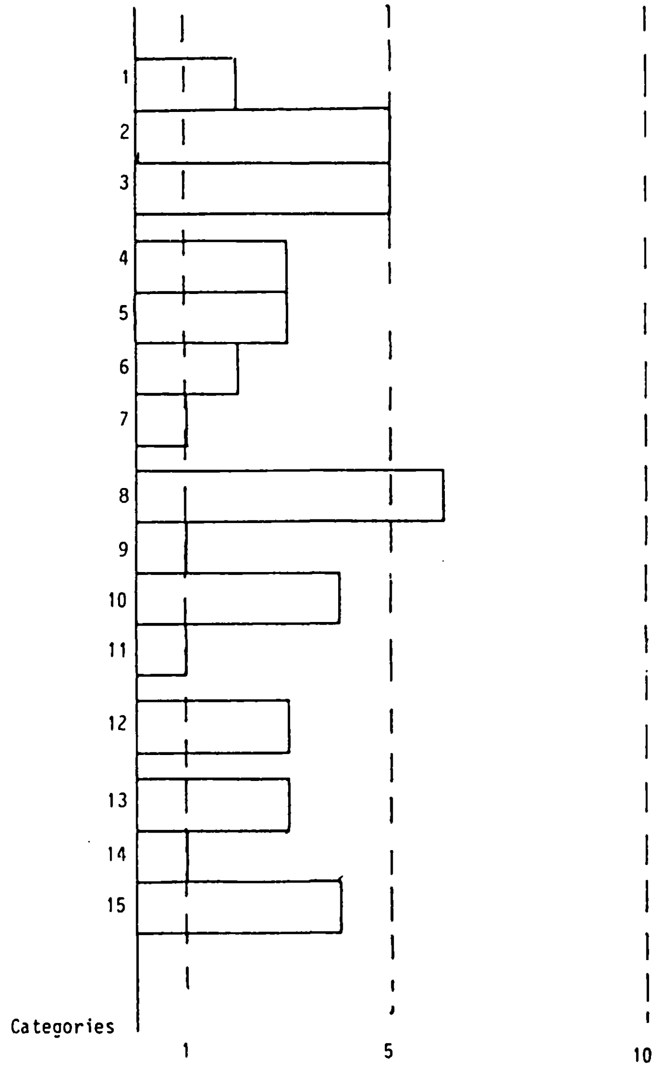


Figure No.29 Mean scores of 6 6th grade pupils in 3 schools
Second observation of 40 minutes in the science lesson

categories increased the amount of social interaction between the pupils and between the pupils and their teachers. This social interaction gives increased exposure to speech (Bench and Bamford, 1979). As stated in Chapters 2 and 4, these methods improve the knowledge of pupils, as well as improving their language.

(iii) Results and discussion of interviews with teachers and pupils

The teachers and pupils involved in the course were interviewed to find out how the course was viewed.

- Interviews with the teachers:

The following core questions were used for the teachers' interviews:-

1. What is your reaction towards the units?
2. What is your opinion about this method of teaching hearing impaired children?
3. How did the pupils generally react to the unit?
4. What are the management problems you have had to solve and how did you use the management guide?
5. What is your opinion about this method concerning the talking and writing of the pupils?

The results of the interviews with the teachers were very interesting. All of them had positive reactions with this method. One said "Although it is new for me, I am very glad to teach it" and others mentioned "The method is very new and satisfying for the teachers, especially when considering that this unit is a difficult one, even for normal pupils."

The teachers expressed the opinion that this was a successful method for teaching the hearing impaired because it gave the information to the hearing impaired pupils step by step and there was a mutual exchange between pupil and teacher. "The explanation for the content was very clear." "The pupils used all their activities, not only writing, but reading, speaking and doing practical work which helped them to understand the units." "The pupils perceived the lesson quicker than the traditional method which I had been using. They recalled what was learnt every time you asked them about this content." One of the teachers emphasised this comment by saying "Once we went on a picnic to the garden. After a while the pupils came to me with some plants and started to call each part of the plant and argued about what the flower's colour was and what it looked like. Why this grass is green and the other is yellow." The teacher continued "It never ever happened before." Another teacher said "It is an excellent method for teaching pupils with impaired hearing. They comprehend the material very easily, due to the visual aids such as colour, pictures, cutouts, *etc.*, which help them to stay in the class and get interested in it." Another teacher claimed "It also helps some pupils to calm down, like EASA, who never pays much attention."

Generally, the pupils' reactions to the unit were also positive. This was supported by all the teachers with comments such as: "pupils had higher activity because of the practical aspects in this unit and the mutual help among them to talk more." Another teacher said "New relationships were established between the pupils in the classroom, such as in break time." Another stated "We can feel the interest from the pupils when they carried on and paid attention to what was being taught, although the bell rang."

The teachers were then asked if there were any problems or difficulties in using the learning materials and teaching strategies with pupils. All eleven teachers said there was no difficulty, because "everything was clear, particularly the teacher's guide and in addition, your initial training with us was good."

The last question related to the teachers' opinions about the value of the method with regard to the development of language for the pupils. There were the following comments: "This method has raised the talking capability and writing, as well as reading, of the pupils, although not all of them to the same extent. They had increased their vocabulary." "They learnt the geometrical forms, measurements with the aid of a ruler, even the English numbers which were written on the rulers."

- Interviews with the pupils

The following core questions were used for the pupils' interviews:

1. What is your reaction towards the units?
2. How does the unit compare with your previous mathematics and science studies?
3. How did you find the network of the worksheets? Can you easily progress from one activity to another?
4. Did you have any difficulty with words used?
5. Is it difficult to understand these worksheets?
6. What new words have you learnt? What do they mean? Where do you think you will use these words?
7. Did you enjoy working with your partner? Did you talk to one another?
8. Would you like to learn other subjects this way?

The pupils' interviews yielded some very interesting results. All of them had positive reactions towards the units and were happy to work with this method.

Their answers to the second question indicated that they had achieved greater understanding in science and mathematics because of the variety of lesson activities, such as reading, writing and practical work. The old method was that of copying the teacher's blackboard notes only. They could not ask questions of the teacher and were afraid the teacher would clean the blackboard before they had finished writing.

All the pupils found the network helpful in progressing from one worksheet to another, as well as in progressing from one activity to another. However, all agreed that teacher guidance on the method was required in the introductory lesson.

The pupils admitted to having difficulty with some of the technical words, but the glossary sheet aided understanding. The teacher explained any words if asked about their meaning. (The investigator's view is that there were some difficult words because pure Arabic was used.)

The pupils were then asked if the worksheets were difficult to understand. They claimed that it was not difficult to understand the worksheets and repeated that they were happy to work with this method because it allowed time to question and discuss with friends and the teacher what they did not understand.

All the pupils affirmed that they had learnt many new words, together with their meanings. Some examples of their responses are:

"When I did some gardening with my father last Friday, I recognised the difference between annual and perennial plants." "When my brother wants to share a bar of chocolate with me, I give him exactly half, as if I had measured it with a ruler. In addition to half, I also know all the words which are used in the Fractions unit." (The investigator asked him what the meaning was of the numerator and denominator and he answered without any hesitation.) Another pupil said "I know now when my mother sends me to buy some cream that I need more money to buy a half than to buy a quarter."

The pupils enjoyed working with their partner because in talking together when working they understood the lessons better. By discussion they helped each other to correct language, select correct answers to any questions, in addition to completing the practical work.

All the pupils would prefer to be taught other subjects in this way. They emphasised the learning of mathematics overall, science subjects, history, geography and the Arabic language.

(iv) Analysis and discussion of the record card

The record cards of all the pupils at the three schools (experimental group) were read (see microfiche). From the analysis of the record cards of the fourth grade at the three schools, it was found that all the pupils had completed all the worksheets which made up the Fractions and Plants units. However, all the pupils in the fourth grade, with the exception of those at School No.1 did not find worksheet (soldiers) easy to solve and need further explanation by the teacher and had to do the exercise twice before solving it correctly. It is reasonable to assume that the ease with which the pupils at School No.1 solved their worksheets was because the teacher had a degree in science and her explanation at the commencement was probably of a higher standard than those of the other teachers, who had never taught the Fractions unit before. Teachers not only require training in teaching the hearing impaired, but also require courses on the basic information contained in the subjects before they are competent to pass this knowledge on to the pupils.

In the Plants unit, all the worksheets were done, but all the pupils in grade four at the three schools found difficulty working with worksheets (stems store food), (leaves), and (leaves store food). This probably means that these worksheets were of a higher level than their cognitive level, or that they need to be explained more clearly in simple language, or perhaps omitted from grade four, because it was noted that all pupils had the same difficulty, regardless of who taught them.

No such problems were experienced by the pupils in grades five and six with the mathematics and science worksheets. Only a few pupils had to rework the questions and some of the experiments before obtaining the right answers and this is considered to be due to the individuals and their abilities. All pupils completed all the worksheets for the mathematics and science units.

2. Matched Pairs

There were seven matched pairs at the six schools; one pair at fourth grade, two at fifth grade and four at sixth grade. The factors which were taken into account for matching were:

- written language pre test;
- the degree of hearing loss;
- IQ (see Chapter 5, Tables 6-8).

All the matched pairs were tested on their spoken and written language, mathematics and science attainment. In addition, the control group was observed by the investigator once in mathematics and once in science. The experimental group were observed by the investigator additionally in their own classroom, once in mathematics and once in science. The children in the experimental group were also interviewed by the investigator and their record cards were analysed.

The basic social health and educational information was extracted from pupils' personal records and conversation with social workers, as well as the information on parental education background.

This section contains a report on one of each of the matched pairs described above, *e.g.*, one from fourth grade, one from fifth grade and one from sixth grade. The other matched pairs are detailed in the Appendix 25.

(i) Matched pair at fourth grade

(a) Seham (experimental school)

Seham is a fourth grade pupil at experimental school No.1. She is nine years and three months old and has three sisters and three brothers. She is the middle sibling with three older sisters and three younger bothers. Her father works as a gardener and is only just able to read and write. Her mother is a housewife and is illiterate.

Seham's hearing impairment was caused by having whooping cough when she was 18 months old. This hearing loss was not discovered until she was six years old and about to start school. As mentioned earlier, there is no general hearing screening test in Iraq.

From the age of six, Seham attended the special school for hearing impaired children, having completed all the admission stages. She has a 50 dB hearing loss and her IQ, as determined by the 'Draw a Man' test was 112.

Seham is very shy and quiet and this has exacerbated her problem because of a lack of communication between her and her teachers and her peer group. She experiences many problems - lack of expression, poor writing, inability to pay attention to the teacher and reading - which affect her educational development.

During the six weeks course, Seham has demonstrated rapid progress in both spoken and written language, as can be seen from the pre- and post-test scores (see Figures 30 and 31). Her progress in mathematics and science over the period of the course is shown in Figures 32 and 33. These pre- and post-test scores would suggest rapid and significant improvement.

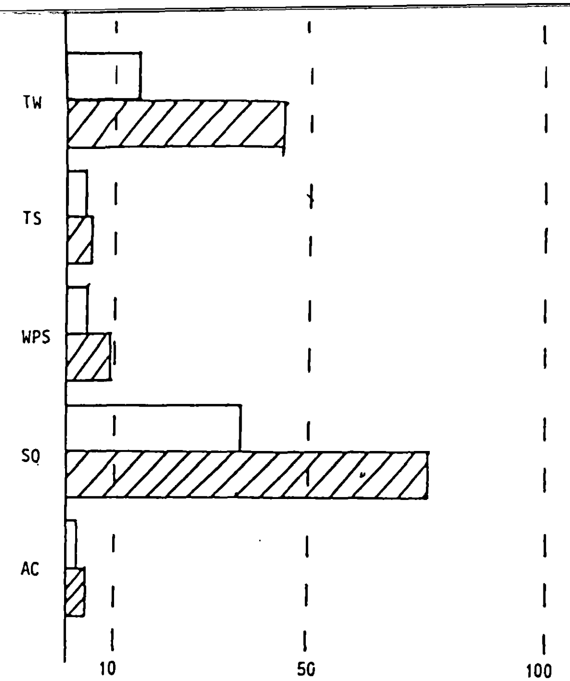


Figure No. 30 Results of the spoken pre- and post-tests

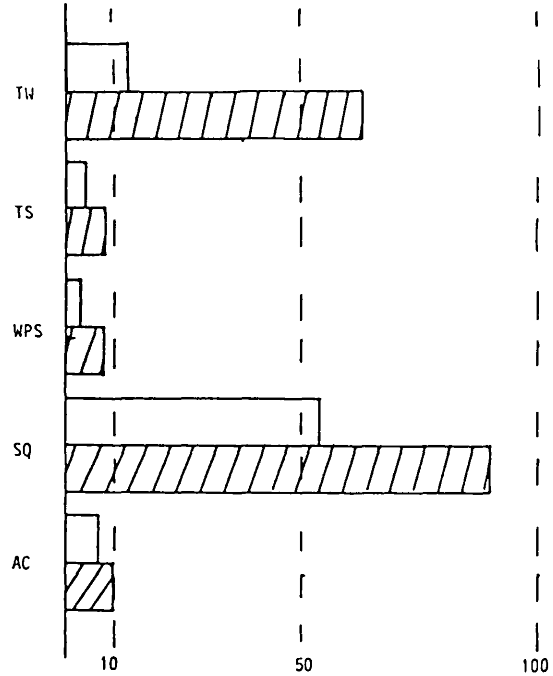


Figure No.31 Results of the written pre- and post-tests

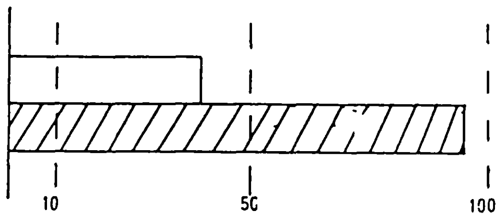


Figure No. 32 Results of the mathematics pre- and post-tests

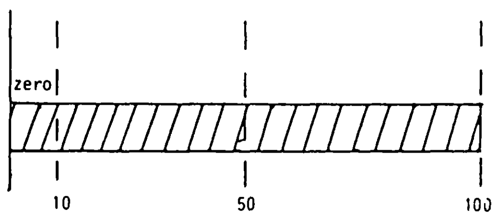
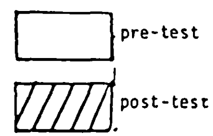


Figure No.33 Results of the science pre- and post-tests

Results of Seham pre- and post-tests



TW = total words
TS = total sentences
WPS = words per sentenct
SQ = syntax quotient
AC = abstract concrete

Seham learnt to pay attention to the teacher and concentrate on the work sheets. Photograph 13 illustrates this point. Seham showed an ability to speak and co-operate with the teacher and other pupils and her level of classroom participation also increased (see photograph 14). Her writing improved, as did her ability to answer questions from the work sheets. This was recorded by her teacher on the record card - illustrated in photograph 15.

Observation by the investigator over a period of fifty minutes during science and forty minutes during mathematics demonstrated the amount of time spent on a variety of activities (see observation check list shown on page 185).

Photograph No. 13 Seham reads the mathematics work sheet

Photograph No.14: Seham explains the lesson (science).

Photograph No.15: Seham occupied with her writing.

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials	2	2
2) reading the materials	2	4
3) writing	4	4
2. The pupil with his/her group		
4) talking to another pupil	2	6
5) talking to the group	2	2
6) listening to another pupil	2	4
7) listening to the group	2	2
3. Practical work		
8) doing some practical work alone	4	6
9) doing some practical work with a friend	2	6
10) doing some practical work with the help of the teacher	2	2
11) doing some practical work with the help of a friend	2	2
4. Playing		
12) behaviour and activities not related to task	2	0
5. Teacher talks to pupils		
13) at pupil's request	2	2
14) without a request from the pupil.	2	2
15) by giving an announcement, talk, explanation to the whole group/class	8	6

Seham's observation check list over forty minutes during mathematics and fifty minutes during science.

(b) Telba (control school)

Telba is a pupil in the fourth grade at school No.6 (control school), who was matched with Seham at school No.1.

Telba is nine years and five months old. She has four brothers. She is the oldest child in the family. Her father works as a labourer in a shoe factory and his education level is such that he can read and write. Her mother is illiterate and a housewife.

When Telba was only 24 months old, she had measles with a high fever, which affected her hearing. As previoulsy mentioned, there was no hearing test until she attended this special school at six years old. She passed through all stage for admission to this school. She has a 53 dB hearing loss. Her IQ, as determined by the 'Draw a Man' test was also 112.

Although she is quiet, she has no problem with communicating with other pupils, or with her teachers. She pays attention to her teacher, she copies the lesson from the blackboard. Despite her hearing impairment and consequent lack of language development, her overall educational development is good.

Figures 34-37 illustrate her results in the language, mathematics and science pre- and post-tests.

During the course, the investigator observed Telba in the classroom, using the same observation check list (see page 188).

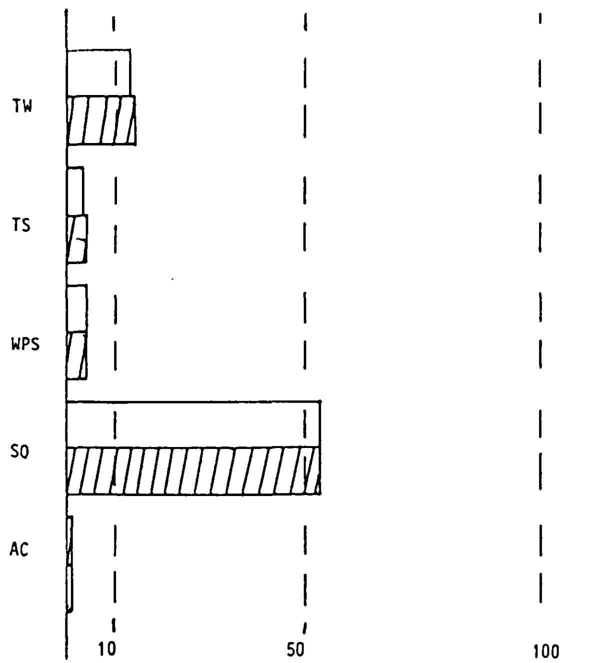


Figure No.34 Results of the spoken pre- and post-tests

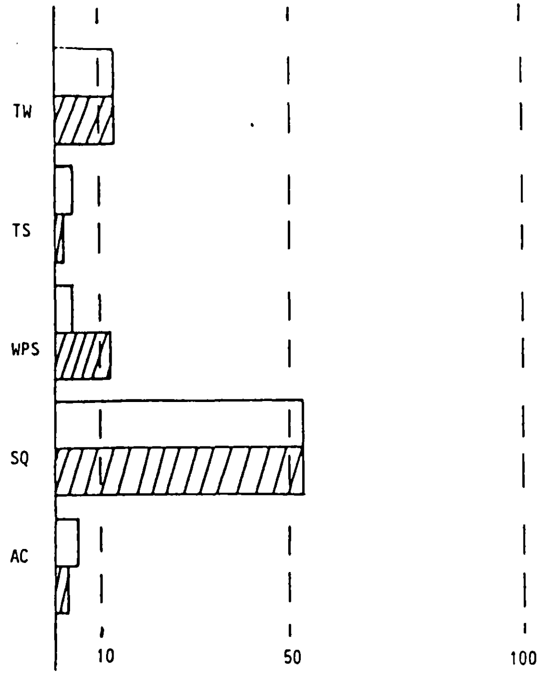


Figure No. 35 Results of the written pre- and post-tests

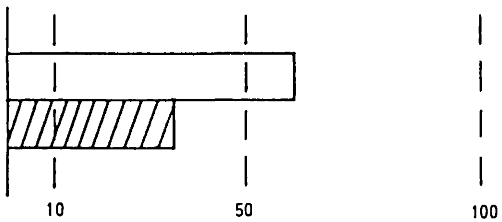


Figure No. 36 Results of the mathematics pre- and post-tests

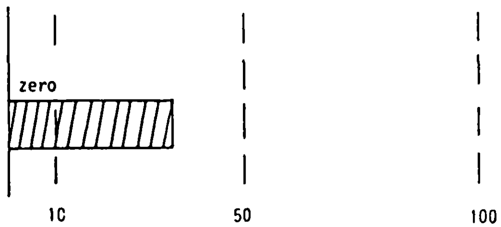
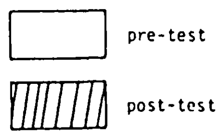


Figure No. 37 Results of the science pre- and post-tests



Results of Telba pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	18	26
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activites not related to task		
5. Teacher talks to pupils		
13) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	22	24

Telba's observation check list over forty minutes during mathematics and fifty minutes during science.

(ii) Matched pair at fifth grade

(a) Mohaned (experimental school)

Mohaned is a pupil at grade five in school No,3, which is an experimental school.

Mohaned is ten years and three months old. He has three sisters and three bothers and he is the youngest. He was diagnosed as a hearing impaired child with 66 dB hearing loss and has an IQ of 113. He had jaundice when he was just 29 months old, which caused his hearing impairment. He attended the special school at six years old. His father and mother were educated to primary school level. His father works as a labourer and his mother is a housewife.

He had a very bad report. He does not come to school regularly, but attends only once a week. Fortunately, he came to the school when the language pre-test was administered to the pupils. Since that day he started coming to school every day. His teacher was surprised and asked him why he now came to the school every day. He replied 'I like pictures and stories.' 'I like mathematics and science now.' 'I like to speak freely.' He continued 'You have never helped me to understand the lesson, but now I do not care if you are in the classroom or not, I can teach myself.' The teacher really was embarrassed by this, but she has a high morale and said 'I see! Why did you not tell me this before?' He replied 'I was afraid that you would hit me!' Then she asked him 'Are you happy now?' to which he replied 'Yes I am, and I am going to come to school every day to learn, then I can work and live.' He was really aggressive with her. The teacher then turned to me and said 'Do not believe him - I have never hit any pupil.'

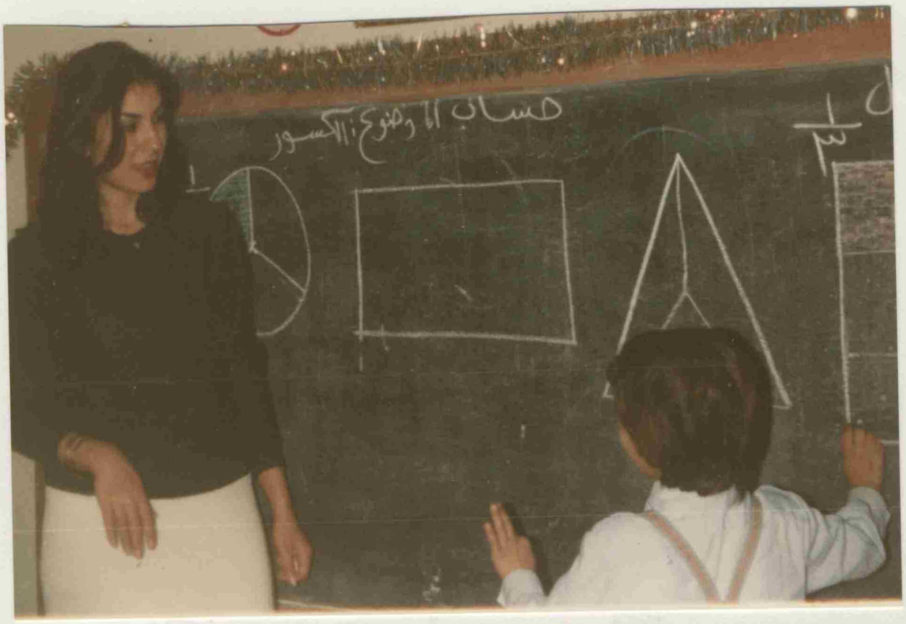
Mohaned began to come by public 'bus to get to the school early. He was afraid to miss the lesson in the morning, which made his family and the school worried about him.

During the course, he began to mix with other pupils and his teachers. He began to speak more freely with other people and became curious. For example, one day my brother gave me a lift to Mohaned's school early in the morning and we saw him standing outside the school because the cleaner had just cleaned the school and sent him out. He came towards us and said 'Good morning - where have you been? I have not seen you for a long time.' He did not give me a chance to reply, but continued 'Who is that chap?' I said 'My brother'. He said 'I see, I thought he was your son. So why is he so thin? Oh, he is very tall.' My brother smiled, then Mohaned asked him 'Would you be upset if I tell you something?' My brother said 'No, ask what you like.' Mohaned put his hands in his trouser pockets and looked up, thinking as we waited for him to speak. 'Ah, you look like a wire - tall and thin, but would you like to be my friend?...' and for nearly half an hour he was chatting with my brother.

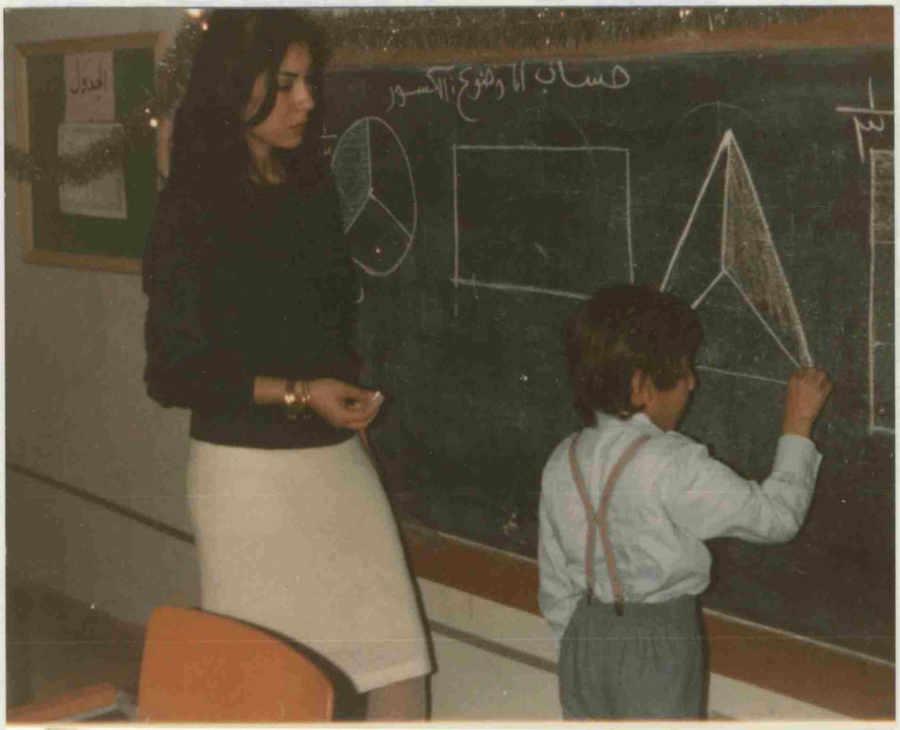
To return to the subject of Mohaned in the classroom, he is trying to work hard to show the teacher that he is improving. He has progressed in answering questions in both mathematics and science. This was entered on his record card by the teacher in these words: 'He participated in explaining the lesson to the teacher, as well as the pupils (see photographs Nos. 16 and 17).

His language and knowledge in mathematics and science were tested with the same pre- and post-tests used with other pupils. The results of these tests are shown in Figures Nos. 38-41.

His behaviour, as with other matched pairs, was observed in the classroom once in mathematics and once in science (see page 194).



Photograph 16: Mohamed explains the mathematics lesson to the teacher.



Photograph 17: Mohamed explains the mathematics lesson to the teacher.

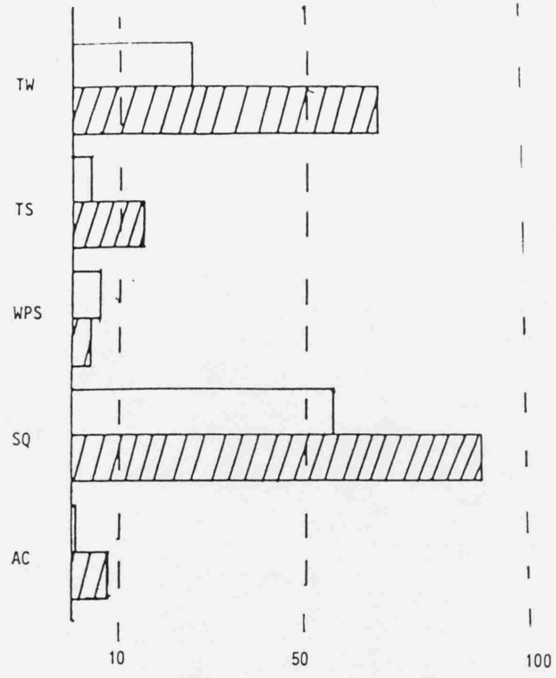


Figure No.38 Results of the spoken pre- and post-tests

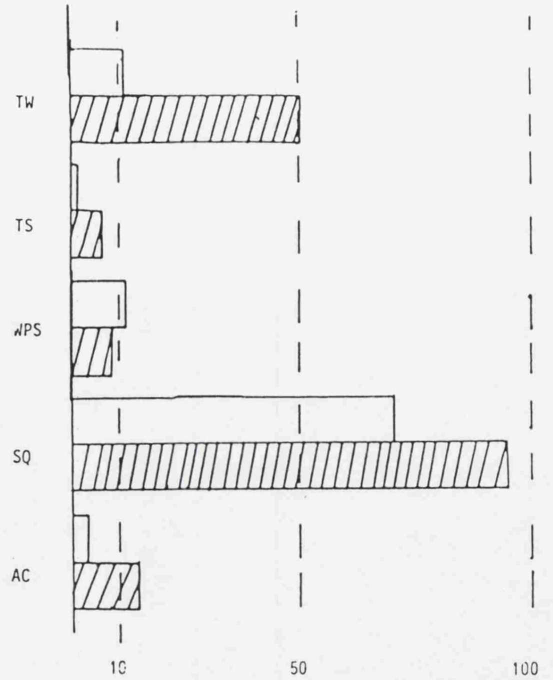


Figure No.39 Results of the written pre- and post-tests

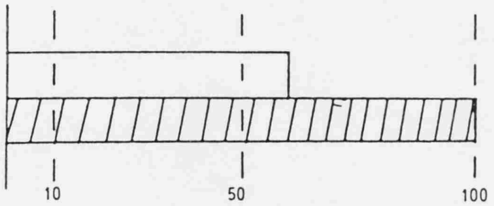


Figure No.40 Results of the mathematics pre- and post-tests

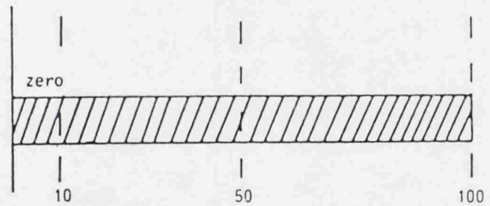
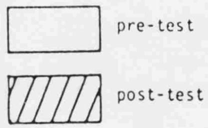


Figure No.41 Results of the science pre- and post-tests



Results of Mohamed pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract con...

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials	2	6
2) reading the materials	2	2
3) writing	4	2
2. The pupil with his/her group		
4) talking to another pupil	2	4
5) talking to the group	4	2
6) listening to another pupil	2	2
7) listening to the group	2	2
3. Practical work		
8) doing some practical work alone	2	8
9) doing some practical work with a friend	6	8
10) doing some practical work with the help of the teacher	4	4
11) doing some practical work with the help of a friend	2	2
4. Playing		
12) behaviour and activities not related to task	0	0
5. Teacher talks to pupils		
13) at pupil's request	2	2
14) without a request from the pupil.	2	2
15) by giving an announcement, talk, explanation to the whole group/class	4	4

Mohaned's observation check list over forty minutes during mathematics and fifty minutes during science.

(b) Reád (control school)

Reád is a pupil in the fifth grade at school No.4 (control school), who is matched with Mohaned at school No.3.

Reád is ten years and eight months old. He has two sisters older than him and three younger brothers. His father's education level is middle school and he is a policeman. His mother's education level is primary school and she is a housewife.

Reád had whooping cough when he was 30 months old, which caused his hearing impairment. He has a hearing loss of 66 dB and an IQ of 106. He attended the special school at six years, five months.

His report is full of notes. For example, he does not do his homework regularly, does not respect his teachers or his group, does not pay attention to the teacher, is stubborn sometimes and argues all the time with his group. Although he has all the above problems, his expression within language and his knowledge are at a good level.

His language and knowledge in mathematics and science were tested by the pre-tests before the beginning of the course and by post-tests at the finish. The results of these tests are shown in Figures Nos.42-45.

Reád's behaviour in the classroom was observed as before, once in mathematics and once in science, the results of which are shown on page 197.

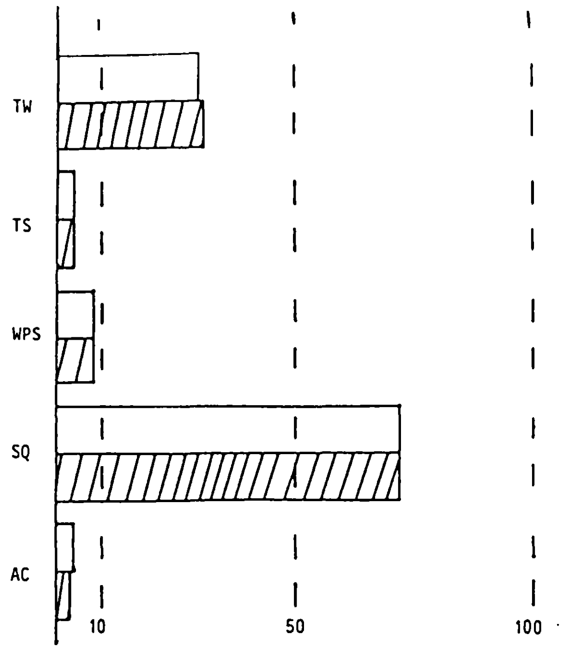


Figure No. 42 Results of the spoken pre- and post-tests

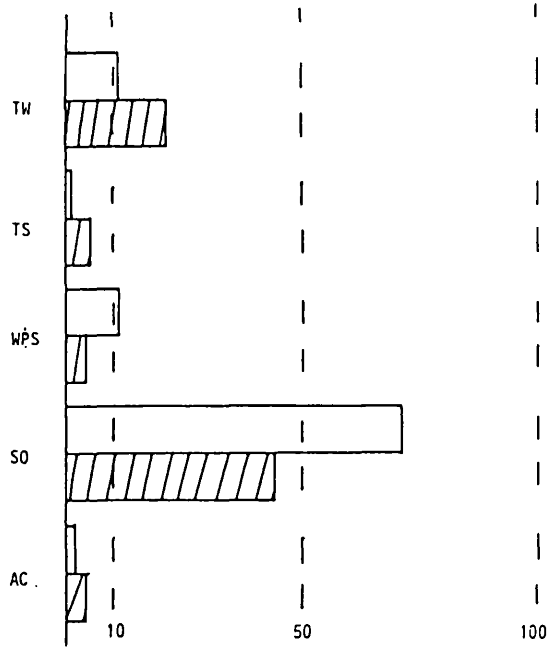


Figure No. 43 Results of the written pre- and post-tests

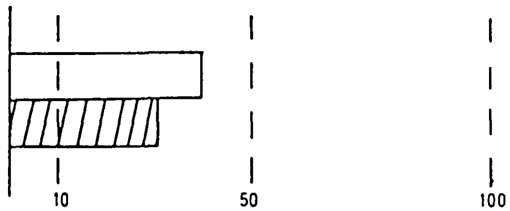


Figure No. 44 Results of the mathematics pre- and post-tests

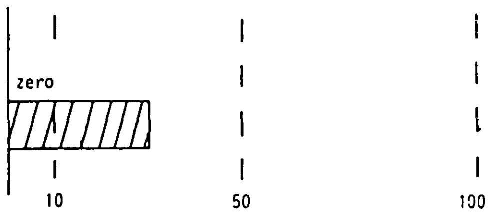
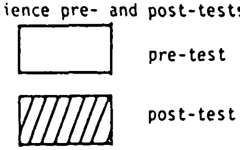


Figure No. 45 Results of the science pre- and post-tests



Results of Reád pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SO = syntax quotient

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		2
3) writing	10	12
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activities not related to task	10	8
5. Teacher talks to pupils		
13) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	20	28

Read's observation check list over forty minutes during mathematics and fifty minutes during science.

(iii) Match pair at sixth grade

(a) Neáma (experimental school)

Neáma is one of the pupils at grade six, school No.1 (experimental school).

He is fourteen years old and has four sisters and one brother. He is in the middle. His parent's education level is university, both working as teachers at the middle school.

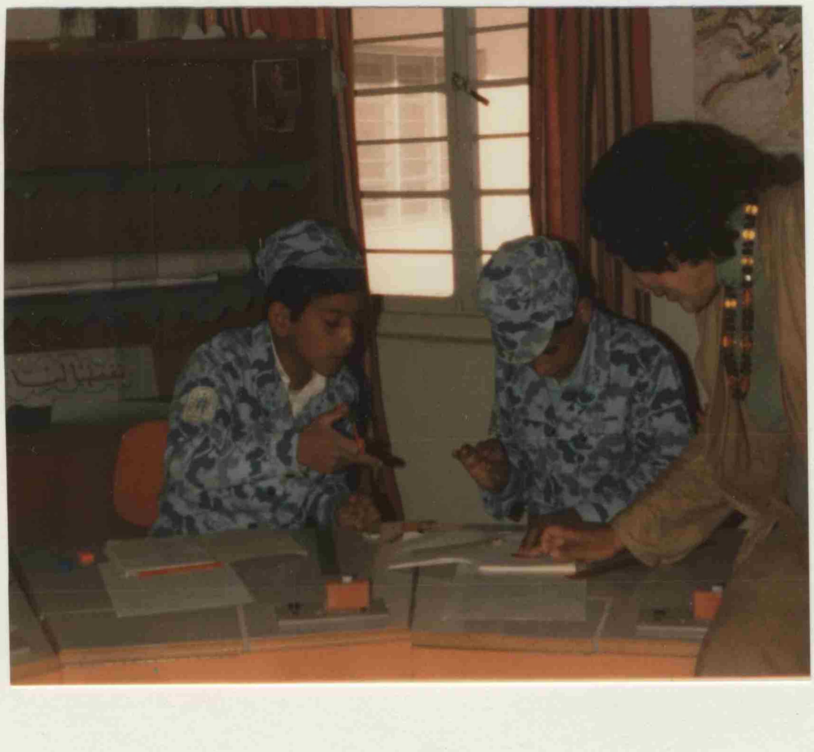
Neáma had mumps when he was 29 months old, which caused his hearing impairment. He has a hearing loss of 53 dB and an IQ of 100. He attended this special school at six years old, but has repeated two years.

He had very different reports from those of the other pupils in his group. First of all, his teacher did not want him in the classroom any more, because - as she wrote - 'it is all the same if he comes to the school or not. When he attends, he sits in the classroom but never copies the lesson. He has never spoken with the teacher or the pupils, even outside the classroom. It would be much better if he were to leave the school and help his mother at home. How can his language and knowledge improve if he has these characteristics?'

As contained in his file, the social worker visited his family with him and he introduced her to his mother and his language expression was good. Her reaction was that Neáma needs more care from the teacher to make him speak and write and co-operate with others.

During the course, Neáma completely changed. He started to learn by becoming interested, as photograph No.18 illustrates! He used all his senses for the experiment and at first did not believe that the magnet moved the piece of wood until he tried it for himself. In photograph No.19

Photograph No.18:
Science lesson



Photograph No.19:
Mathematics lesson

Neáma can be seen expressing realy interest, explaining to his friend how to correct the problem. He started to co-operate with the other pupils and the teacher, which greatly improved his language and knowledge and this was confirmed by his record card.

At the end of the course, the teacher blamed herself for what she had written about him and commented 'All I said and wrote about him before is reversed now - thank god I did not dismiss him from the school.'

Neáma's language and knowledge in both mathematics and science were tested by the pre- and post-tests, and the results are illustrated in Figure 46-49. His behaviour was observed once in mathematics and once in science by using the same methods (see page 202).

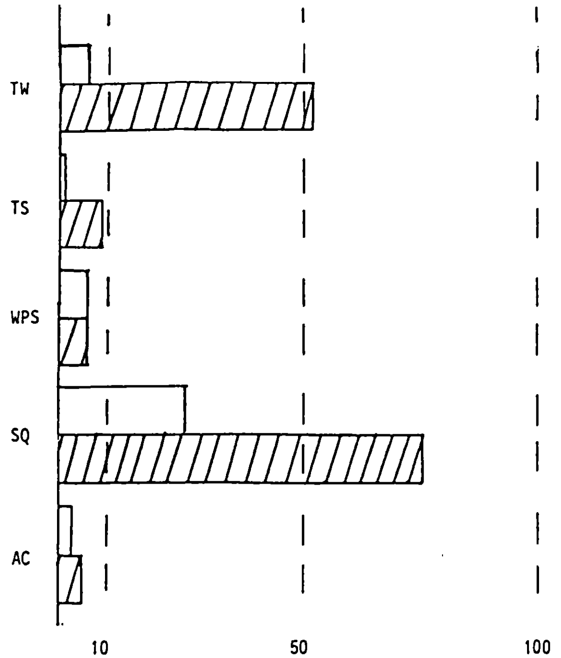


Figure No. 46 Results of the spoken pre- and post-tests

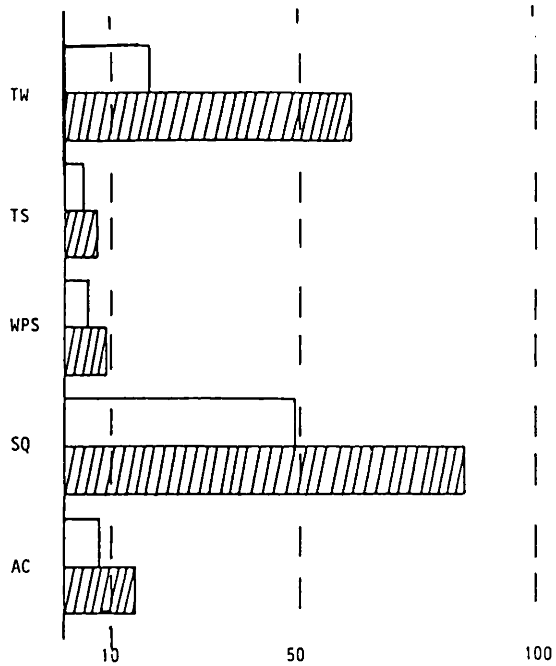


Figure No. 47 . Results of the written pre- and post-tests

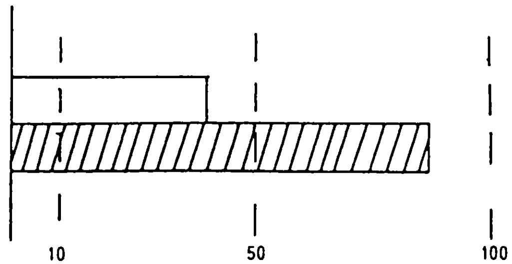


Figure No.48 Results of the mathematics pre- and post-tests

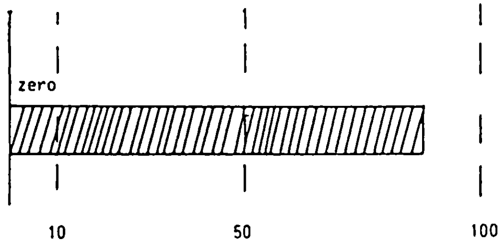
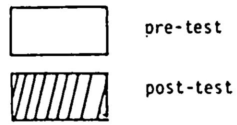


Figure No.49 Results of the science pre- and post-tests



Results of Neáma pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

	Behaviour observed	Mathematics	Science
1.	The pupil by him/herself		
	1) searching the materials	2	2
	2) reading the materials	2	2
	3) writing	8	6
2.	The pupil with his/her group		
	4) talking to another pupil	2	4
	5) talking to the group	2	4
	6) listening to another pupil	2	2
	7) listening to the group	2	0
3.	Practical work		
	8) doing some practical work alone	10	4
	9) doing some practical work with a friend	2	2
	10) doing some practical work with the help of the teacher	2	2
	11) doing some practical work with the help of a friend	4	2
4.	Playing		
	12) behaviour and activities not related to task	0	2
5.	Teacher talks to pupils		
	13) at pupil's request	2	2
	14) without a request from the pupil.	2	2
	15) by giving an announcement, talk, explanation to the whole group/class	8	4

Neáma's observation check list over fifty minutes during mathematics and forty minutes during science.

(b) Zynal (control group)

Zynal is a pupil in the sixth grade at school No.6 (control school). He is matched with Neáma at school No.1.

He is fourteen years old. He has two sisters and two brothers and is the eldest in the family. His father's education level is university and he works in an office. His mother's education level is middle school and she works as an assistant teacher in a kindergarten.

His hearing impairment was caused by having whooping cough and a high fever at the age of 33 months. He attended this special school at the age of six, has a hearing loss of 53 dB and an IQ of 100.

He comes to school regularly and does his homework, but his communication with teachers and other pupils is less than the other pupils in his group. The teacher said that sometimes he looks at me in a strange manner, but never says a word.

I will never forget when I was in his classroom and the lesson was over, he spoke to me with tears in his eyes and I prompted him 'Do you want to ask me something?' 'Yes, I want..' I said 'What?' He said 'Are you a new teacher? Are you going to teach us?' I really did not know what to respond. Then I said 'Yes, but not in your school.' Then he said in a very warm voice 'Could you please tell our teacher not to talk in a very high voice, Miss? We are deaf.' He said this word and looked as it something hurt him. 'But we have hearing aids and we hear quite well when she speaks. Why doesn't she use the amplification?' I looked at him again and again and he really looked sad by this treatment. I privately thought that I hoped he would be in the experimental group, because he will be happy and his language and knowledge will improve more than would be the case in this school and probably his confidence as well.

Zynal's language was assessed by the pre- and post-tests, as well as his knowledge in mathematics and science. Figures 50-53 illustrate the results of these tests.

His behaviour was observed once in mathematics and once in science by the same method (see page 206).

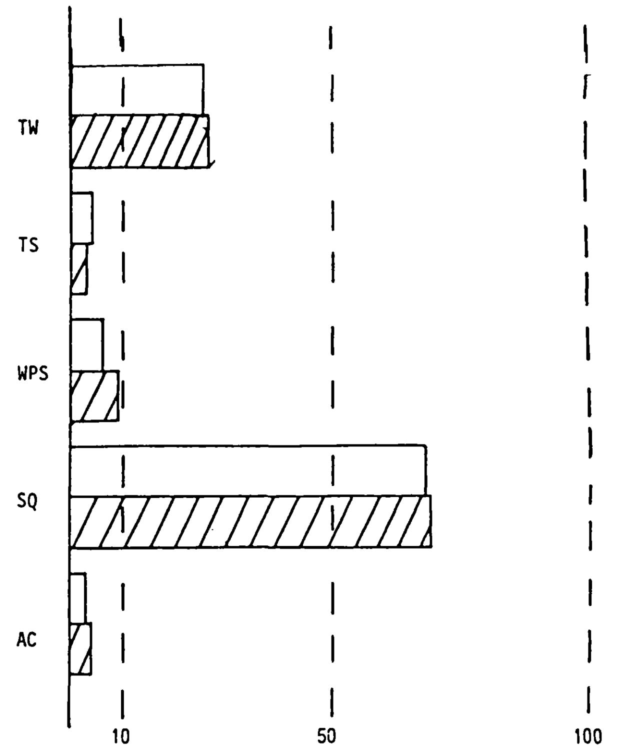


Figure No.50 Results of the spoken language pre- and post-tests

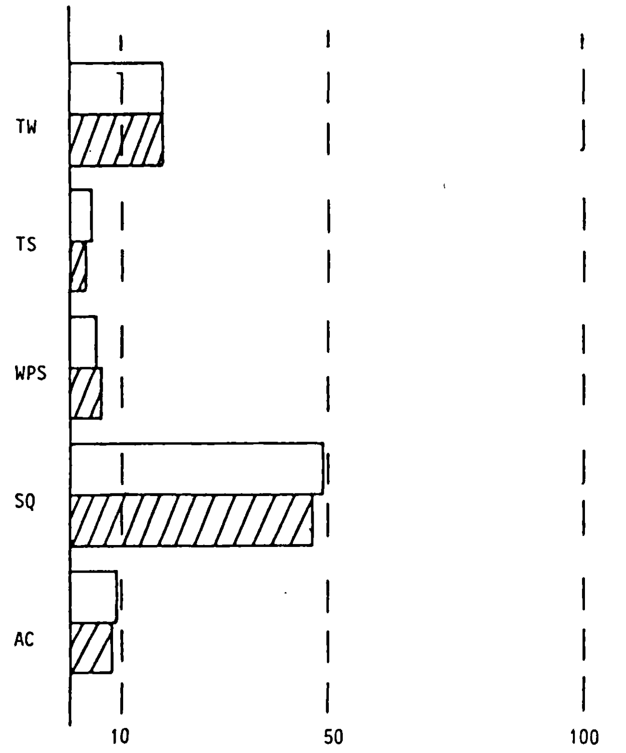


Figure No.51 Results of the written language pre- and post-tests

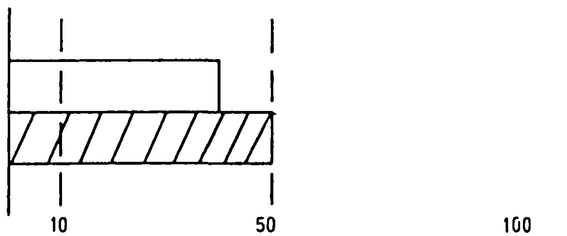


Figure No. 52 Results of the mathematics pre- and post-tests

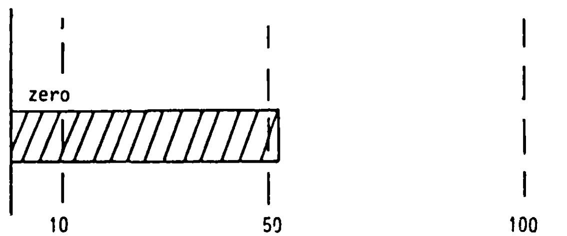
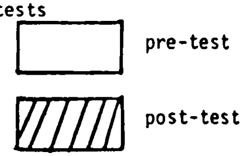


Figure No.53 Results of the science pre- and post-tests



Results of Zynal pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	28	24
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activities not related to task		
5. Teacher talks to pupils		
13) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	22	16

Zynal's observation check list over fifty minutes during mathematics and forty minutes during science.

3. Discussion of the Results

The above results gave the investigator the impression that after the six weeks course in Mathematics ('Fractions' unit) and Science ('Plants' and 'Magnetism' units), the spoken and written language of the hearing impaired pupils had improved, in addition to their knowledge of the content of the subjects taught. On the other hand, the control groups generally showed little or no improvement in language.

On the following pages there is a discussion about the effects of the new teaching strategy on the results of the experimental group. In addition, some possible reasons for the retrogression of the results shown by the control group in the post-tests (language and knowledge) are given.

There were three statements in the results section of the language and attainment tests for the two groups (control and experimental) and the matched pairs, as follows:-

1) To ascertain any significant differences between whole control and experimental groups at the pre-tests (language 'spoken and written' and attainment 'mathematics and science') and between the same two groups at the same post-tests, with the aid of the Mann-Whitney U test.
2) To ascertain any significant differences between mean scores of the pre- and post-tests for the same level of grades 4, 5 and 6 in the two groups, using the t-test.
3) To ascertain any significant differences between the mean scores of pre- and post-tests for the matched grades, using the t-test.

(1) Language tests

In summary, the results of the language tests from the three statements reveal the following:

1) First statement

All the results obtained from this statement were statistically significant at a level of 0.01, using the Mann-Whitney U test in spoken and written language, except words spoken per sentence, in the pre-test.

2) Second statement

From this statement, it is concluded that there were statistically significant differences between the control and experimental groups in all aspects of spoken and written language at level 0.01, using the t-test, apart from words spoken per sentence.

3) Third statement

All the results of the matched grades of the control group were not significant in written or spoken language. (There were some significant results in the control group, but as previously stated, they revealed a significant regression.)

Many of the matched grades in the experimental group had more than one aspect of spoken and written language which did not show a statistically significant improvement at a level of 0.01 (t-test). Tables Nos.65 and 66 illustrate this:

Table No. 65 Results of the spoken language aspects for the experimental matched grades which were not significant

Grade Schools	4	5	6
1	WPS	WPS AC	
2	WPS	TS WPS	TS WPS
3	WPS	WPS	WPS

Table No. 66 Results of the written language aspects for the experimental matched grades which were not significant

Grade / Schools	4	5	6
1	AC	AC	
2		WPS	TS, WPS SQ
3	WPS	TS WPS	TW

The results of the matched pairs (control group) spoken and written language post-tests reveal that some of the pupils showed a slight improvement in one or two aspects. However, other pupils remained at the same level, with scores which were lower than those of the pre-test (see section on page 180).

The spoken and written language of matched pairs in the experimental group improved a great deal with the exception of Mohend (words spoken and written per sentence), Kesma (words spoken per sentence) and Neáma (words spoken per sentence), (see section on page 180).

From these results, it would appear that the written language of the experimental group had improved in all aspects of the test; when large sample parametric or non-parametric statistics were used, in addition to the findings of the matched pairs, with the exception of Moamad, who showed no improvement in words written per sentence, The results also show that the experimental group improved in their spoken language (apart from the WPS aspect). On the other hand, the control group did not show an improvement in their spoken or written language when the data were analysed using both the parametric and non-parametric techniques. Some of the individual pupils (matched pairs) showed a slight progress in some aspects of the language test.

According to the above results the words per sentence aspect (WPS) of the test did not improve in general.

Let us know consider the different aspects of the language test. The discussion will focus largely on written language, because there has been little research into the spoken language of the hearing impaired. As Myklebust (1964), Quigley and Paul (1984) and Webster and Ellwood (1985) state, the written language of hearing impaired children has received more research attention than spoken language, because a written sample is static and less open to ambiguity. It is intended to compare the results of the written aspects of normal hearing children in Iraq with those of hearing impaired children in Iraq, because there is no Arabic test available for comparison with the results of the present study. It should be borne in mind, however, that the sample of normal hearing Iraqi children was small and the comparison is therefore limited.

I <u>Total words (TW) aspect</u>

The total words (TW) (spoken and written) of the experimental group, as illustrated in the results section, improved in all grades of all school, with the exception of grade 6 in School No,3 (written). This is because hearing impairment limits the amount of written language used in a given situation. Even though progress is observed, the rate of maturation is significantly reduced and the evidence does not suggest that retardation is gradually overcome (Myklebust, 1964). The teaching strategy, which was used with the experimental group, was the same. However, teachers were different. Individual differences in the expression of ideas in words, as well as confidence and social problems* should be taken into consideration.

A comparison between normal hearing children and hearing impaired children has been undertaken and is illustrated by mean ($\bar{x}$) and standard deviations (SD) - the whole experimental group in a grade (*e.g.*, all pupils in grade 4 together, all pupils in grade 5 together, and all pupils in grade 6 together, and all control groups in the same grades in the pre- and post-tests). These are also compared with the normal hearing in grades as well. The results are shown in Tables Nos.67-69.

Table No.67 The mean ($\bar{x}$) and standard deviations of the written language test total words (TW) for the normal hearing

Grade†	$\bar{x}$	SD
2	56.60	32.43
4	82.93	31.36
6	110.93	52.26

*Bowyer and others (1963) suggested that 'partially hearing children would have more social-emotional problems than either the profoundly deaf or the hearing, because they "belonged" to neither group' in Hawkridge, Vincent and Hales (1985), p.32.

†Age range of normal hearing children is between 7-12. However, the age range of hearing impaired children is between 9-14, because the latter show a retardation in language of more than two years (Hawkridge, Vincent and Hales, 1985).

Table No. 68 The mean ($\bar{x}$) and standard deviations (SD) of the written language pre- and post-tests for the hearing impaired (experimental group), total words (TW)

Test Grade	Pre-test		Post-test	
	$\bar{x}$	SD	$\bar{x}$	SD
4	13.44	2.22	63.26	3.03
5	19.39	1.99	85.19	4.38
6	25.65	2.22	65.32	3.38

Table No. 69 The mean ($\bar{x}$) and standard deviations (SD) of the written language pre- and post-tests for the hearing impaired (control group), total words (TW)

Test Grade	Pre-test		Post-test	
	$\bar{x}$	SD	$\bar{x}$	SD
4	10.19	2.22	12.73	2.28
5	19.11	1.97	19.08	2.32
6	25.71	2.20	19.64	2.55

From these tables it can be seen that normal hearing pupils wrote longer stories at different age levels than hearing impaired pupils (experimental and control groups in the pre-test). This finding is in agreement with Myklebust's results (1964), when he compared normal hearing pupils with hearing impaired pupils in this aspect of language.

The normal hearing children made rapid progress as they grew older. On the contrary, the hearing impaired children in both groups showed slower progress in the pre-test. However, looking at the results of the post-test of the experimental group, it appears that they had made remarkable progress after being taught by the new method, in contrast with the control group, who remained the same or got worse.

The results of the hearing impaired in both groups were affected by the factors previously mentioned; in addition, the progress of the experimental group was also affected by the amount of content in the materials and the time spent on the course. For example, the mean score obtained by the fifth grade on the post-test (TW) exceeds that obtained by pupils in the sixth grade, because there was more content and time spent on experimental material by pupils in the fifth grade. It is of interest to note that following the course, the scores obtained by the experimental hearing impaired group compare favourably with those of the normal hearing group, apart from the sixth grade.

II Total sentences (TS) aspect

Total sentences (TS) means the number of sentences used in this test.

Hearing impaired children use shorter and simpler sentences than normal hearing children (Myklebust, 1964), (Webster and Ellwood, 1985).

The control group showed no significant difference between the pre- and post-tests in this aspect, but the experimental group (all groups, particular grades, matched grades and matched pairs) had statistically significant differences between the pre- and post-tests (spoken and written language), with the exception of some grades in some schools, as presented in Tables Nos. 65 and 66. A possible explanation of this lack of improvement may be due to the teachers, the pupils themselves, or the language experienced during the course itself. The findings from the comparison between the normal hearing and hearing impaired (see

Tables Nos. 70 , 71 and 72) show that there are wide differences between the total sentences (TS) of the normal hearing and those of the hearing impaired for total sentences (TS). The normal hearing write higher numbers of sentences than the hearing impaired (both experimental and control groups) in pre- and post-tests.

The normal hearing showed a slight increase from one grade to another. This finding is not in agreement with Myklebust's finding. He found that the normal hearing pupils showed rapid development between the ages of 7 and 9 years, with little change in the following years. On the other hand, the findings of this study of the hearing impaired are in agreement with those of Myklebust, that the hearing impaired showed a steady growth from age to age.

A comparison between the experimental and control groups in the post-tests indicates that the control group showed a slight improvement or deterioration in contrast with the experimental group, which showed a great improvement in the post-test. Nevertheless, a follow-up study is required to find out the reasons behind the changes of the language results of the grades in the different schools and changes in different grades.

Table No. 70 The mean ($\bar{x}$) and standard deviations (SD) of the written total sentences (TS) for the normal hearing

Grade	$\bar{x}$	SD
2	16.40	10.97
4	16.53	8.67
6	17.73	8.83

Table No. 71 The mean ($\bar{x}$) and standard deviations (SD) of the written total sentences (TS) for the hearing impaired (experimental group) in pre- and post-tests

Test Grade	Pre-test		Post-test	
	$\bar{x}$	SD	$\bar{x}$	SD
4	1.42	0.93	6.65	1.14
5	4.22	1.29	8.75	1.18
6	5.68	1.31	7.63	1.22

Table No. 72 The mean ($\bar{x}$) and standard deviations (SD) of the written total sentences (TS) for the hearing impaired (control group) in pre- and post-tests

Test Grade	Pre-test		Post-test	
	$\bar{x}$	SD	$\bar{x}$	SD
4	2.91	0.94	3.20	1.22
5	4.39	1.40	3.97	1.13
6	5.73	1.31	4.40	1.46

III Words per sentence (WPS) aspect

Hearing impaired children write or speak in short sentences, which is confirmed by Cooper and Rosenstein (1966) as follows: '[Deaf children's] written language, compared to that of hearing children, was found to contain shorter and simpler sentences, to display a somewhat different distribution of the parts of speech, to appear more rigid and more stereotyped and exhibit numerous errors or departures from standard English use' (page 66 in Quigley and Kretschmer, 1982). Kowal (1979) also found that a criterion of mean sentence length of three words seems to suit the ability of almost all hearing impaired children, as 97% of them tended to speak in sentences of that length or longer, but for administrative ease he lengthened his test sentence to five words and these were produced by 87% of hearing impaired children. Myklebust (1964) found from administering his picture story test (written) with hearing impaired children that their sentences were short and simple and the differences between the hearing impaired and the normal hearing were highly significant at all age levels, as well as the rate of growth in the hearing impaired, which was much slower. The results of the present study were in agreement with the above results. Tables Nos. 73, 74 and 75 illustrate the mean ($\bar{x}$) and standard deviation (SD) of the normal hearing and the hearing impaired of both groups (experimental and control). It appears that the normal hearing use longer sentences than those of the hearing impaired in both groups in the pre-test and it is different from grade to grade, as with Myklebust's findings. However, the experimental group of the hearing impaired showed a great difference in the post-test, compared with normal hearing children and the control group of the hearing impaired. It appears from these results that the experimental group made good progress, whilst the control group showed no progress. This is related to the new teaching strategy and other reasons which will be discussed later.

Table No. 73 The mean ($\bar{x}$) and standard deviations (SD) of the written words per sentence (WPS) for the normal hearing

Grade	$\bar{x}$	SD
2	3.43	0.96
4	6.06	2.85
6	7.81	3.90

Table No. 74 The mean ($\bar{x}$) and standard deviations (SD) of the written words per sentence (WPS) for the hearing impaired (experimental group) in pre- and post-tests

Test	Pre-test		Post-test	
Grade	$\bar{x}$	SD	$\bar{x}$	SD
4	5.14	1.33	9.83	1.43
5	5.10	1.23	9.90	1.38
6	4.96	1.14	8.97	1.39

Table No. 75 The mean ($\bar{x}$) and standard deviations (SD) of the written words per sentence (WPS) for the hearing impaired (control group) in pre- and post-tests

Test	Pre-test		Post-test	
Grade	$\bar{x}$	SD	$\bar{x}$	SD
4	4.99	1,32	4.73	1.42
5	4.86	1.41	4,67	1.12
6	4.94	1,18	4.91	1.29

IV Syntax (SQ) aspect

Every language has its unique characteristics (see Chapter 4 for the rules of the Arabic language) and its use assumes adherence to precedents which have evolved concerning a given symbol system. The rules which govern the use of language have been referred to as the parts of speech, sentence structure and grammar, syntax, referring to the patterns of formation and structure of sentences is more inclusive.

The syntax aspect includes four types of accuracy: syntax, word formation, word choice and punctuation. When scored according to this scale, incorrect usage falls into three categories: word usage, word ending and punctuation. Within each of these categories there are specified error types as follows: word usage: additions, omissions, substitutions; word order; word ending: additions, omissions, substitutions; punctuation: additions, omissions, substitutions (see Chapter 4).

The origin of deriviant syntax in hearing impaired children does not arise from any intellectual defect (Furth, 1966). The problem most likely arises from limited and distorted language to which most deaf children are exposed (De-Machin, 1981).

Brannon and Murry (1966) compared normal hearing, partial hearing and deaf children's total spoken language output and syntactic accuracy by obtaining the number of addition, omission, substitution and word order errors observed in a spoken sample. The partial hearing group resembled the normal hearing group in total output, but the deaf were significantly lower on these measures. The differences between syntactic accuracy scores were significant among all three groups. As the hearing level decreased, the accuracy of syntactic production decreased accordingly.

Myklebust (1964) compared normal hearing with hearing impaired children. He found that the normal hearing achieved higher scores than the hearing impaired, and also that the normal hearing made less errors than the hearing impaired. Moreover, as age increased, the error scores for the normal hearing decreased, whereas for the hearing impaired the scores remained remarkably similar from one age level to the next. The most common error was omission: essential words left out. Next in order of occurrence was substitution, followed by addition and word order.

The investigator of the present study compared normal hearing with both groups of hearing impaired children (experimental and control) in pre- and post-tests by mean ($\bar{x}$) and standard deviations (SD) (see Tables

Nos. 76, 77 and 78).

Table No. 76 The mean ($\bar{x}$) and standard deviations (SD) of the written test, syntax quotient (SQ) for the normal hearing

Grade	$\bar{x}$	SD
2	78.65	11.75
4	81.54	13.58
6	87.53	8.24

Table No. 77 The mean ($\bar{x}$) and standard deviations (SD) of the written test, syntax quotient (SQ) for the hearing impaired (experimental group) in pre- and post-tests

Test	Pre-test		Post-test	
Grade	$\bar{x}$	SD	$\bar{x}$	SD
4	52.89	2.91	85.39	2.26
5	65.04	2.80	84.55	2.36
6	65.29	3.45	87.83	2.02

Table No. 78 The mean ($\bar{x}$) and standard deviations (SD) of the written test, syntax quotient (SQ) for the hearing impaired (control group) in pre- and post-tests

Test	Pre-test		Post-test	
Grade	$\bar{x}$	SD	$\bar{x}$	SD
4	52.32	2.89	52.80	3.10
5	63.04	2.89	54.34	2.47
6	63.90	3.41	56.04	3.63

From the above tables it appears that some of the results of the present study are in agreement with those of Myklebust. It appears that the results of the comparison between normal hearing and hearing impaired (both experimental and control groups) in the pre-test are in agreement with Myklebust's finding that there was a difference between the scores of the normal hearing and the hearing impaired in the syntax aspect.

The results of the control and experimental groups in the pre-test were the same, or only slightly different. However, in the post-test the control group got similar or lower scores as for the pre-test, but the experimental group obtained greater scores when compared with their pre-test. In addition, the experimental group obtained higher mean scores ($\bar{x}$) than those of the normal hearing children.

As mentioned in Chapter 4, the most common errors of the written language for the normal hearing in the present study were found in word usage (substitutions, omission, addition and word order), word endings (omissions, substitutions and additions) and punctuation (omissions, substitutions and additions), (see illustrative stories by the normal hearing.

The most common errors of the hearing impaired in the pre-test spoken and written were in word usage (word order, omissions, additions and substitutions), word endings (omissions, substitutions, additions), punctuation (omissions, - they did not use any kind of punctuation).

In the post-test, the control group remained with the same errors, but the experimental group had progressed in syntax for the written and spoken tests. The most common errors were in punctuation, as in the pre-test, with the continued omission of any sort of punctuation and in other errors they resembled the normal hearing children (see illustrative stories by matched pairs in the pre- and post-test).

The above finding suggests that the hearing impaired in the experimental group had made less errors than those in the control group in the post-tests.

There is no agreement between Myklebust's finding and this study with regard to punctuation. He found, as previously mentioned, that three types of punctuation scores were obtained: errors of addition, omission, and substitution. The results showed that the hearing impaired were superior to the hearing on all three scores. Both groups made more errors of omission, not using the necessary punctuation. However, the hearing made many more such errors than the hearing impaired and never attained an equal degree of accuracy; the difference was statistically significant. Myklebust said that the reason for this was possibly because the hearing impaired learn language visually and punctuation is predominantly a visual phenomenon.

Hearing impaired children made the above errors, as confirmed by Myklebust (1964) in the United States and Perry (1968) in Australia, but these categories (of errors) did not prove very useful in explaining why the children made these mistakes. Investigations with hearing impaired children in English syntactic difficulties described by Quigley, Power and Steinkamp (1977) and Ivimey (1977) provide considerable evidence of patterns underlying mistakes. Ivimey states that 'the errors are not random errors, but together form a structured and ordered syntactic system. This system is used to generate and to understand sentences' (page 92). However, the results of the present study of the hearing impaired shows that they lack punctuation. The reason for this may be that the time of the course was not long enough for the hearing impaired to acquire the necessary skills. The evidence of punctuation usage for hearing impaired children required a further study. The normal hearing put punctuatio- as illustrated in the illustrative stories, (see pages 225-234).

V Abstract-concrete (AC) aspect

The abstract-concrete aspect provided a measure of the extent to which imagination and conceptualisation was used in writing or telling a story. In obtaining this score, verbal facility and accuracy of language usage was ignored. Hence we could evaluate the degree of abstraction irrespective of the adequacy of the language used (see Chapter 4 for further detail).

As mentioned before, all the control groups had non significant differences between pre- and post-test scores, which means that the control group, as a different grade in different schools, and even as matched pairs, did not show progress in this aspect (spoken and written).

In contrast, the experimental group obtained a significant difference between pre- and post-test and they improved in this aspect in their spoken and written language in all groups, all grades and matched pairs apart from some grades of the matched grades, as stated in Tables Nos. 65 and 66. This may be due to the pupil's background in the language experience (*e.g.*, the amount of language they had acquired in their childhood), age and teachers. Myklebust (1964) compared normal hearing and hearing impaired in this aspect and found that the results disclosed a progression by age for both groups in the use of abstraction. However, the hearing impaired were inferior to the hearing at all age levels.

These results are in agreement with the finding of the present study of the normal hearing (see Table No. 79). However, there is not the same

Table No. 79 The mean ($\bar{x}$) and standard deviations (SD) of the written test, abstract-concrete (AC) for normal hearing pupils

Grade	$\bar{x}$	SD
2	10.76	7.08
4	12.90	6.22
6	13.00	6.47

agreement with the results of the hearing impaired in pre- or post-tests (see Tables Nos. 80 and 81). The control group's results were less than those of the experimental group in the post-test because of the abstract-concrete aspect, which is affected by the experience of the language, their imagination ability (the experimental group developed this during the course), and also because their syntax is less. This is confirmed by Myklebust (1964) who stated that when language is limited, vocabulary is poor and syntax is poor as well, then these are also inter-related with the development of abstract thought.

Table 80 The mean ($\bar{x}$) and standard deviations (SD) of the written test, abstract-concrete (AC) for the experimental group (hearing impaired) in the pre- and post-tests

Test	Pre-test		Post-test	
Grade	$\bar{x}$	SD	$\bar{x}$	SD
4	5.05	1.25	9.60	1.56
5	3.69	1.10	9.19	1.69
6	7.17	1.19	12.75	1.55

Table No. 81 The mean ($\bar{x}$) and standard deviations (SD) of the written test, abstract-concrete (AC) for the control group (hearing impaired) in the pre- and post-tests

Test Grade	Pre-test $\bar{x}$	Pre-test SD	Post-test $\bar{x}$	Post-test SD
4	5.41	1.22	4.45	1.24
5	3.69	1.17	3.81	1.07
6	7.23	1.19	5.02	1.34

If one considers the illustrative stories of hearing impaired pupils which were translated into English, word for word, it can be seen that pupils in the experimental group had improved in their language. It was found that they did not use many technical words which they learnt in mathematics and science, but when interviewed, some of them mentioned many technical words and knew their meaning. It could be that they did not express these words because they thought they had to write stories and so avoided technical words. Nevertheless, they learnt the general language which helped them to improve in mathematics and science.

The language results revealed that the written language for the hearing impaired had improved more than their spoken language. However, pupils spoke freely to a greater degree than before (a cassette was available for some lessons in mathematics and science - see supplementary materials).

The investigator concluded that the age of pupils is very important with regard to learning the language. The younger pupils learnt quicker than the older ones. This gives the impression that hearing impaired children have had to: identify their impairment at an early age; use hearing aids; and receive auditary training to help them learn the language and which affects their ability to learn in other subjects.

It would appear, therefore, that the new teaching strategy should be employed early on in the schooling of the hearing impaired.

هذه رنا / وهذا عمر / كانت رنا نظرت
وتصنع ثيابا لدميتها / اما عمر فهو
كان يلعب بالمغناطيس ويلتقط الدبابيس /
توجد
ويوجد بجانبهما ستوانه ورق / وعلى الرف
ساعة ومزهرية ومكتب واما سهما مكتبة كتبها
كتب ربا مثات ، مزهريه فيها ورود جميل
ليزين الغرفة ./

Illustrative story written by a normal hearing child at grade 2.

حم: في البيت

كانت مرح مع اخيها علي يلعبون في البيت كانت مرح
تلعب تخيطلي الدمية وكان علي يلعب بالمغناطيس
وكانوا يلعبون على الطاولة وكانوا جالسين بقرب خشبة كان عليها
كتب ومزهرية وساعة وكانوا جالسين ايضا بقرب
طاولة عليها مزهرية وكان ايضا بجانبهم كرسي وعليه
صندوق العب وعلى الطاولة الاخرى سندانة فيها نبات
عالي اخضر جميل .

Illustrative story written by a normal hearing child at grade 4.

الموضوع:
كيف يقضي سعاد وخالد وقت فراغهما

انشاء

في يوم من الأيام كان اليوم هو يوم الجمعة فبدأت سعاد تلبس
دميتها ملابسها التي اعطاها لها وكان اخوها خالد يستمتع في صنع
التجارب العلمي الذي كان يقول عنها المانيه جدا وكانت بجنبهم
مكتبة فيها كتب كثيرة ومفيدة وكانت سعاد تقول اني تعودت ان
اخيط لدميتي الجميلة ملابس جديدة وقال خالد وانا تعودت
ان اصنع تجربة جديدة واعطيها الى مدرس العلوم فقالت سعاد
لنفسها وهل تعلمت كل ما احبك الذي كنت بانك حتى تتفرغ للتجارب
قال: نعم وسوف اساعد اختي عندما اتم تجربتي الحديدة التي
تتعلق بالمغاطيس و هكذا نعم كيف يقضيان كل ساعة
بدون تضيع الوقت

Illustrative story written by a normal hearing child at grade 6

دمى وعلياء

كان علي وعلياء يلعبون بالدمى فقالت علياء غدا عيد ميلادي
فقال لها علي كل سنة وانت بخير فقالت له اشكرك يا علي فقالت
علياء ماذا سيحضر لي ابي فقال يمكن ان يحضر اليك لعبة جميلة
وبالفعل احضر ابوها لها لعبة جميلة ومع اللعبة كتابان جميلان
عن النصف والربع [illegible] امي [illegible] نبات اخضر جميل [illegible]
[illegible] انه مطاط [illegible] ان نعتني به

Ali and Alyiá were playing with dolls.
Alyiá said tomorrow is my birthday
Ali said to her happy birthday she said
thak you Ali Alyiá said what my father
going to bring me he said he migh bring
you a nice doll and indeed her father brought
to her a nice doll with two nice mathe-
matics books about half and quarter my.
mother brough me a nice green plant
do you know what it is Ali it is
rubber and we must look after it

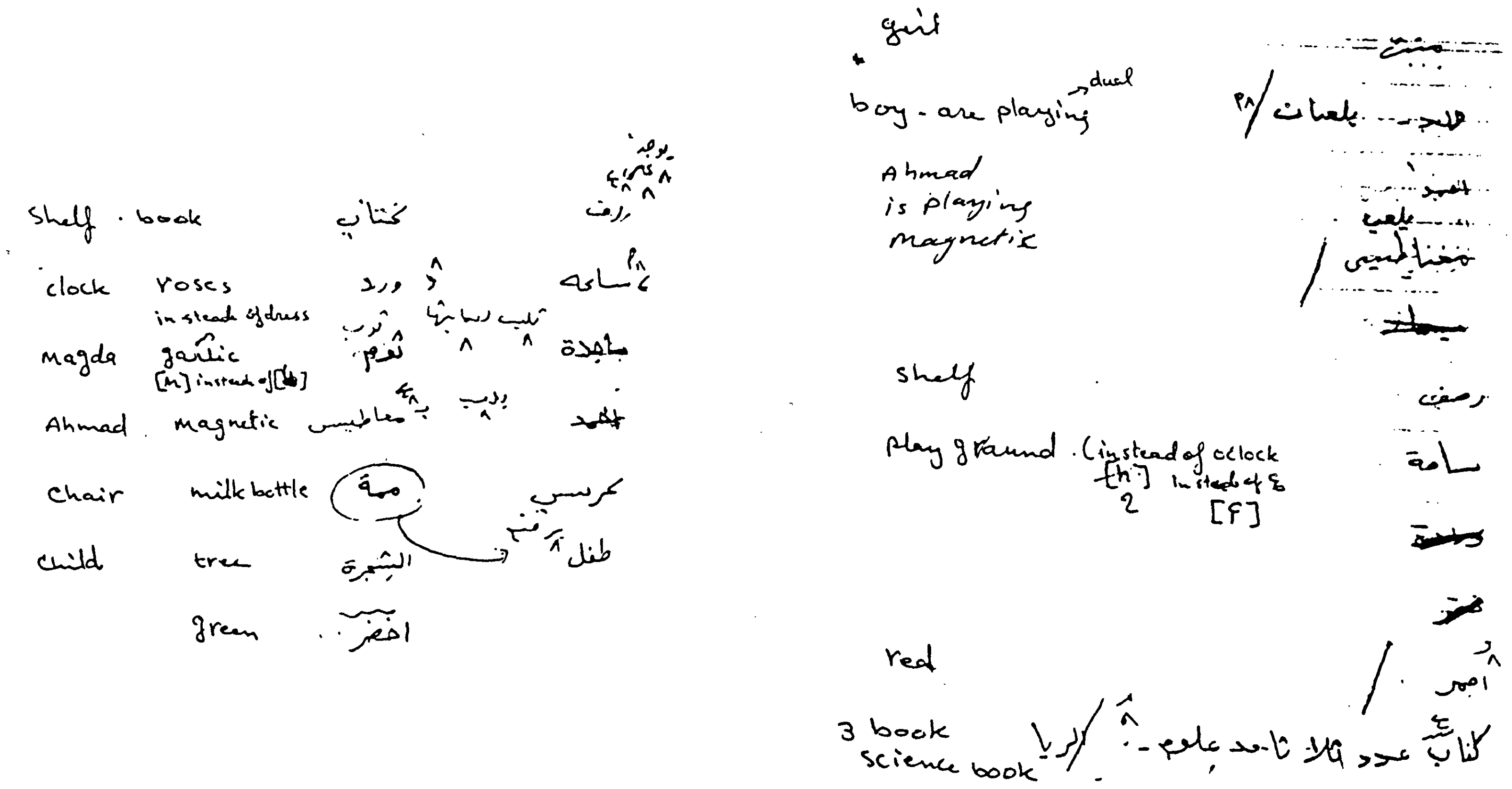
Post-test

سهام تلعب باللعبة ايمان محمد على رف ساعة
[illegible] محمود [illegible] ورود حمراء [illegible]

Seham plays with a doll Eman Mohammed on
shelf clock roses vase Mahmmod chair
red

Pre-test

Illustrative stories written by Seham, a child om grade 4 of the experimental group.



Post-test

Pre-test

Illustrative story written by Talba, a child in grade 4 of the control group, matched with Seham.

انشاء

ان هذه البنت تلعب بلعبتها و هذا الولد يعمل تجارب/ بها

بالساعات على المنضدة/ وكتب ارفف ساعة وكتب ومزهرية

يوجد فيها زهور/ وتوجد منضدة صغيرة يوجد عليها شتلة

انهم فرحان/ وكانوا فرحات بعلبها/ وكان بجانبها كرسياً يوجد

عليه صندوقاً فيه لعب الجميلة التي يلعبون بها/

This girl is playing with her doll and this boy is doing some experiment they are sitting at the table on the shelf there is an o'clock books vase with flower there is a small table and a pot flower with gree plant on it they were happy there was a box full of nice dolls which they were playing with and it was on a chair beside them.

Post-test

بنات	مكتبة	Self	book
ورد	رف	o'clock	roses
شرب	ساعة	Sajedeh	dress
حليب	ساجدة	Ahmaad	magnetic
هدية	احمد	Chair	milkbottle
	كرسي	Child	
	طفل		

Pre-test

Illustrative stories written by Mohemad, a child in grade 5 of the experimental group.

رف ساعة ورد الرياضيات عربي
ولد محمود يلعب الكرسي الاسم حنان يلعب باللعابة
ساعة اربعة مزهرية وورد
تلبس اخضر شعر اسود ..

Shelf o'clock roses mathematics
Arabic boy Mahmed is playing chair
the name is Jenan is playing
with doll clock four vase roses
wearing green black hair.

Post-test

البنت تلعب بلوعبها والولد يلعب بلوعبو
وهم عم يضحكو

The girl is playing with her dolls the
boy is playingwith ~~with~~ his dolls and
they laugh and happy.

Pre-test

Illustrative stories written by Reád, a child in grade 5 of the control group, matched with Mohamed.

في هذه الصورة فيها بنت وولد والبنت تطرز
والولد يلعب بالمغناطيس وفي الصورة مكتبة
وفي المكتبة كتب ودفاتر وصور هرية وساعة
وعلى الميز لعب للاطفال وعلى
الطبلة [illegible] زهرية والولد نظيف والبنت
مشغولة في الحياكة والتطريز
والغرفة جميلة وملابس البنت نظيفة والولد
نظيف ايضا والمكتبة [illegible] مرتبة [illegible] في الصورة
ميز و [illegible] المزهرية جميلة وكتب [illegible] ولا
نسى [illegible] المغناطيس [illegible] اكبر من

Post-test

قصة

ذات يوم [illegible] عصام يعمل المغناطيس [illegible]
[illegible] ساعة على الرف وردة كتاب على المنضدة احمر
وكتبا [illegible] عصام [illegible] وهنا [illegible]

Pre-test

Illustrative stories written by Kesma, a child in grade 6 of the experimental group.

In this picture there is a girl and a boy
the girl is doing a needle work the boy
is playing with magnet and in the picture
there is a Shelf on the Self there are
books copy books and a Vase and clock
and on the table there are dolls for
Children and on the table vase the boy
is clean and the girl is busy sewing and
doing needle work the room is beautiful clean
as well the shelf is tidy I saw in the picture
atable a a chair and a beautful Vase and
Mathematics books quarter and half and
we should not forget that magnet puals
iron half is begger than quarter

Post-test

Story

Nada is playing her hair is black he is
doing a magnet his hair is black vase
green plant clock on the self round book
on the table red Esám is wearing a blue
Jumper chair on it boX

Pre-test

The translation of Kesma's stories.

عنوان القصة ألعب

كان في قديم الزمان

الولد يلعب بمغناطيس والبنت تلعب بالعروسة ... والولد بمغناطيس

... صندوق اللعب ... ساعة ... وخمس ... وكان أو ...

... الكتب ... البنت سميرة والولد محمد

The title of the story is "playing"

Once, upon a time

There is a girl and a boy

The boy is playing with magnet and the girl is playing with a doll and there is a milk bottle beside her and the boy with magnet and girl nail box playing and o'clock four and five or sellf reading books the girl Samera and the boy Mohammad.

Pre-test

قصة

بات قسمة فرقد ... عمل ورد ... عصام نبات

... صندوق الكرسي على احمر ساعة كتاب بنت باب

الولد يلعب ... مغناطيس خطر ... يعمل حمامة ثوب ...

Ban Kesma Ferkad doing roses vase Esám plant box chair on red o'clock book girl door I am playing magnet danger shelf is doing pigen dress flower Pot

Post-test

Illustrative stories written by Ahlam, a child in grade 6 of the control group (matched with Kesma)

(2) Attainment tests

I Mathematics tests

Referring to the three statements mentioned on page 208, the control group had not progressed in mathematics. This means that they did not gain knowledge from the course taught by the traditional method. Nearly all of the pupils scored less in the post-test (see matched pairs) and the reasons will be explained later.

HOwever, the experimental group improved in mathematics, as the results of the three statements show, as did the matched pairs. This may be attributable to the new teaching strategy, which was administered to them, more than to other factors, such as IQ, degree of hearing loss, age, *etc.*, especially in the matched grades and matched pairs, because of their almost identical score with regard to the above factors.

II Science tests

The results of the science tests revealed that all the pupils of both control and experimental groups had improved in science, since they all scored zero in the pre-test, but gained marks in the post-test at the end of the course. Yet still there was statistically a significant difference between the control and experimental groups in the post-test with the experimental group doing better. Some of the results of the control group in the matched grades were not statistically significant at level 0.01. Detailed information about the improvement in science can be seen from the data for the matched pairs.

The experimental group showed improvement, as revealed by the results of the three statements, as well as the matched pairs. The results of the experimental group were much higher than those of the control group. This was due, as in the case of the Mathematics test, to the new methods.

In other words, the matching process had formed the means of comparing groups, one of which experienced a new approach, whilst the other had continued with the traditional method. A comparison of the two groups after the process showed a significant improvement in the experimental group and little or no improvement in the other. It should always be remembered that the problems of learning for the hearing impaired child are not related to ability, but to the range, depth, mode and amount of language involved: how information is imparted, recorded, reinforces the rest of his learning experience (Webster and Ellwood, 1985). Also, the effects of a language deficiency rapidly increase. Since the hearing impaired children are less able to participate in all manner of educational activities, so their experiences do not add sufficiently to their skills, Lack of skills then affects their performance of the next task, and the accumulated deficiency may eventually be very great (Hawkridge, Vincent and Hales, 1985). The point to be made, then, for example, is that the logic of mathematics is open to the hearing impaired, but the language of instruction may limit the rate of progress. This may be true when a child has to listen to length explanations with little concrete experience. Therefore teaching mathematics has to be done with concrete experience and language (Webster and Ellwood, 1985). It can be suggested that one of the reasons which affects the language is the function of memory. Memorising things is one of the greatest difficulties in language teaching to hearing impaired children (Uden, 1977). We therefore have to train the hearing impaired to memorise the language in which they will be educated, *e.g.*, asking them to repeat longer sentences and copying written sentences. As Arnold, in his study 'The Memory of Deaf Children' (1979) stated, 'in the teaching situation, learning and memory have relationship that is both intimate and dynamic, We teach material, facts, figures and skills, and expect that these will be remembered. We test the child's recollection of this material so as to check on whether it has been learnt. It can be seen that learning and remembering are two sides of a complex of processes. Processes that psychologists are only in the early stages of understanding'.

Hodge (1981), referring to Piaget's test finding (1967) of sentences transformationally, suggests that thought deployed on decoding language is unproductive in problem solving. Language here is using up too much of the child's intellectual capacity. While a language form is unfamiliar it will attract too much attention and will be a hindrance to thinking. Therefore language development will have to come before a cognitive development which depends on it in some way.

The above is related to the findings of this study that the knowledge of the experimental group was dependent on the improvement of their language. However, the control group showed little or no improvement in language or in knowledge.

When hearing is impaired, vision should be used instead. It must also be remembered that the hearing impaired have a lack of memory and the relationship between learning and suffering from deafness has been emphasised by Hovland (1951). Therefore, the new teaching strategy was built upon the theoretical and research work carried out in this area (see Chapters 2 and 4). To educate the hearing impaired, it is necessary to put pressure on visual and tactual pathways (Hawkins, 1983), (Conrad, 1979) and (Myklebust, 1964).

As mentioned in the language chapter, teachers in many classrooms make their deaf and hard of hearing children write daily to develop both written and oral expression.

The investigator found that there was no agreement between the above statement and the results of the control group. Since the control group was taught by the old method, whereby children copy what is written on the blackboard, there was no improvement in their language or their knowledge, which was quite the opposite to the experimental group. From this it can be suggested that notonly writing improves the language and knowledge, but also there were other factors, such as training teachers, written materials, working as individuals and as groups, discussion and practical work.

The above is in agreement with an evaluation for new materials for Scottish integrated science for normal first and second years at secondary schools, which was carried out in 1978 by Kellington and MItchell, using control classes *versus* the first trials. Pupils in control classes were allocated to ability groups in the same way as those in the trials and attempted the assessment tests without following the new course materials, but following the same course with the traditional materials. It was found that the performance of the pupils in the assessment tests could have been affected. Performance was influenced by many other factors, apart from the skill and attitudes of the teachers. Examples of others factors are teaching styles, attitudes of the pupils towards science and the school, time allocated for study of the course, and availability of resource materials and apparatus.

Teaching in diffetent styles, confirmed by the ORACLE research, was also based on classroom observation. The team discovered that the mixed methods in teaching at primary schools were more effective than other teaching styles, (Alexander, 1984). This result is in agreement with the school mathematics project 7-13 (1979), primary mathematics (1984), Nuffield junior science

(1964) and science 5/13. The value of teaching the practical applications of science is also far more than mere reinforcement of learning (Solomon, 1980).

It can be suggested that the improvement of the experimental group in 'Language and Knowledge' is related to the new methods. This result reinforces those of a study which was carried out in Saudi Arabian ordinary schools at sixth and ninth grades by Mostafa (1985). She found that these two grades are almost at the same levels of cognitive development and spatial visualisation; that the ninth grade must depend on lectures, but that the sixth grade get involved in working in groups, discussion, science experiments, use of laboratory equipment, *etc.*

As mentioned above, the practical method improved the language and knowledge of the hearing impaired of the experimental group. This is in agreement with Borron (1978) in his study 'Modifying science instruction to meet the needs of the hearing impaired' which consisted of eight first grade pupils ranged in age from 7 years 11 months to 9 years 11 months. He found that the manipulative nature of the activities in science seem to have contributed to the pupils' successful performance using pre- and post-test techniques. Their learning was not dependent on their language ability. Rather, the desired new language was presented with the experience. In this way, the language was internalised as the symbolic representation of the experience.

All these facts have enabled the experimental group to do much better in the language and attainment tests when compared with the control group. Another fact might be that learning in the experimental group was more pupil oriented than teacher oriented, whereas in the control group it was still centred round the teacher.

Pupils in the control group scored better in some aspects of the language test and in the mathematics test in the pre-test more than in the post-test. One of the reasons for this could be that the language pre-test was administered at the end of the examination of the first term and the children's parents prepared them for the examination. After the language pre-test the children were on holiday for a week, then they had the mathematics and science pre-test. Therefore it could be that they got some individual experiences on holiday which made them do well. However, they fared worse in the post-test because there was no emphasis for their memory. Thus it could be related to the lack of training in the teachers, the continued use of the old method and the lack of emphasis on the different methods which were used with the experimental group.

These results were confirmed by those of observation, interviews with teachers and pupils, and pupils' record cards.

From the observation, it was found that the interaction between the pupils was increasing during the course and they started to discuss topics amongst themselves. Photographs Nos.20, 21 and 22 illustrate this point. Photograph No.20 shows that the pupil in the middle had a problem in solving a question in the science lesson ('Plant' unit, fourth grade). Photograph No.21 shows how the other pupil involved himself in discussing it with her, as well as with the third pupil. However, Photograph No.22 reveals that the pupil did not agree with the other two and went to ask the teacher. Therefore the interaction was not between pupils, but between pupils and the teacher.

Photograph No, 20

Photograph No. 21

Photograph No. 22

From the discussion of the analysis of the record cards, it was found that the record card was very important in giving an indication of the teachers' need for training in the subject content, in addition to training in teaching strategies for hearing impaired children.

The results of the interviews of teachers and pupils indicated that both showed great enthusiasm for taking part in this course.

CHAPTER EIGHT

CONSTRAINTS UPON THE STUDY, CONCLUSIONS, RECOMMENDATIONS

CHAPTER 8

CONSTRAINTSUPON THE STUDY, CONCLUSIONS, RECOMMENDATIONS

1. Constraints upon the Study

I New Teaching Strategy 'Methods and Materials

The conclusion from this study is that the pupils who were in the pilot trial school and experimental schools improved both in their knowledge and language as a result of using the new methods and materials. This is indicated by the results of the tests and confirmed by the observations, record cards and interviews compared with the pupils in the control schools.

The pupils and teachers in the trial and experimental schools showed an enthusiam for working with these methods. The information from the matched pairs confirmed these views, in addition to all the results from the interviews with pupils and teachers involved.

- Hawthorn effect

Most studies, like the present study, are influenced by the Hawthorn effect. This factor is used to describe what happens when a new approach such as a new teaching method has been introduced and the pupils involved show improved achievement (*i.e.*, they are learning more), not because of the new approach itself, but simply because it is new. That is, their attitude has changed: they have been stimulated to better achievement (but it may be only temporary) because of the novelty, or because of the extra attention they get.

The pupils not only improved in science and mathematics, but also their language improved. The language improvement is an indirect effect more obviously related to the teaching strategies and less likely to be a Hawthorn effect in such a short time.

The incredible improvement of the language attained by the experimental group during the course of mathematics and science was achieved in so short a time (not more than a third of the time of the school week over a six weeks period). This improvement could be due to the new methods which were founded on resource based learning. An interesting aspect gained by using these methods with experimental groups is that some aspects of their language had approached the language achievements for normal hearing children in Iraq, as mentioned in Chapter 7. What would happen to the language achievement of normal hearing children with this teaching strategy?

II Sample

As previously stated, there are seven special schools for hearing impaired children in Baghdad. One of them was chosen as the pilot trial school for the new teaching strategy. Three of them were involved with the new teaching strategy in the field trial, the rest were involved in the field trial as control schools.

The 90 pupils (the total pupil population) in the fourth, fifth and sixth grades at the four schools used in the pilot and experimental studies were involved with the new teaching strategy. The number of teachers involved with the new teaching strategy at the four schools was 15.

There were certain constraints governing the selection of the sample. In the first instance the sample had to be small, concentrating on hearing impaired children attending schools in Baghdad itself. The primary reason for this was the difficulty of travelling throughout the country. In addition, these difficulties were exacerbated by the war; some areas where there were schools for hearing impaired children were in the war zone.

The sample of available children with which to try out the new materials was further reduced by the need to create experimental and control groups.

In addition, it was not possible to work with pupils in grades 1, 2 and 3 because of their lack of language development and lack of written ability. Because of the war and the design of the field trial into experimental and control groups, other pupils were deprived of learning by these methods and other teachers were deprived of training to teach hearing impaired pupils, using the new strategy. However, despite the constrains upon the system, several conclusions and recommendations could be reached.

III IQ and Hearing Test

A lack of personnel to administer a more up-to-date test and time constraintfor working in these schools meant that the investigator was obliged to depend on information from the pupils' files to gain their IQ and degree of hearing loss.

IV Methods of Collecting Data

Methods which were used to evaluate the course included: tests, observation, interviews and record cards.

- Tests included: a) spoken and written language tests;
  b) mathematics and science attainment tests.

a) Spoken and written language tests

The spoken test has limited value, because its validity and reliability were not tested in any way other than as reflections from the written test. In addition, there have been few studies done in spoken language with which to compare the results of the present study. The pupils in the experimental group who were taught by the new teaching strategy 'Methods and Materials' appeared to improve considerably in their spoken language, whilst making progress in mathematics and science.

The written test could be used in further studies and practice with hearing impaired children; it also has potential for use with normal hearing children, but this may need further validation.

b) Mathematics and science attainment tests

There was no standardised test of science (Plants or Magnetism Unit) and mathematics (Fractions Unit) for use with the pupils to give an indication of their attainment in these units.

The investigator therefore constructed the mathematics and science tests. One of the criticisms of these tests is of their reliability. The difficulty was to find this out in the pilot trial because a different content was used in the pre-test from the post-test. The other difficulty was that the sample of pupils was too small in the pilot trial.

In the field trial, the pre-test content was the same as the post-test, but the pre-test did not give a real indication of the reliability of the tests and especially the science test, because all the pupils in both groups (control and experimental) scored zero. The results, therefore, of the post-tests were used to calculate their reliability by using the Alpha method, as well as the inter marker scores.

Taking into consideration the fact that pupils at primary schools with hearing impairment are difficult to control for a long period of time, tests were deliberately designed to be simple and short. Thus, tests of mathematics and science could have covered the content more if they had been longer.

The other criticism of the science tests is that they were of one type of question only. This type was the completion question, which limits the range of answers.

The above reasons made the correlation between the attainment tests 'Mathematics and Science' and language test 'spoken and written' lower, and in some respects, negative. Appendix 26 shows the results of this correlation, which was obtained by Pearson correlation co-efficients. It would be worth doing a follow-up study using free recall questions to make correlation between the pupils' knowledge of science and their language.

- Observation

The criticism of the observation method was the reliability of the check list. As mentioned before, a way to obtain the reliability of an observation check list is to record lessons by a video and display them to a number of workers who are trained to make a tally (/) in the appropriate box if the behaviour occurs in a defined period. Because of the situation in the country at the time of the present study, the investigator could not record these lessons by video. It is difficult for this to be done any other way, such as training other people and using them in the classroom, because this would affect the work of both the pupils and the teachers and their interaction. For these two reasons, the only possibility was to hold a discussion between the teachers and the investigator after each lesson, for checking. It was felt that this gave a reasonable assurance of face validity.

- Interviews with teachers and pupils

One of the criticisms of these interviews is that the questions were not frankly answered (*e.g.*, both teachers and pupils did not tell us that there were some worksheets which were difficulty for the pupils to understand). Perhaps this happened because of the teachers' and pupils' positive reactions to the new method, so that they unconsciously covered their answers and did not tell us the negative points of the new method. The questions might have been more frankly answered if the teachers were given open-ended questionnaires, without putting their names on them.

- Record card

There were no problems with the design of the record card and it was an important document to provide us with information about each pupil in each grade such as their progress in the course, the problems which they face. Moreover, it showed us points of difficulty which the pupils faced with some of the worksheets, which the investigator could not discover from any other method. The only criticism is that the physical format (*i.e.*, the paper) was easily damaged or destroyed and card would have been better,

V Using Multiple Methods

The investigator developed the mathematics and science attainment tests, language test, observation checklist and had to use them because there were no tests available and ready to use. All these methods were potentially weak in their reliability or validity, as previously mentioned.

The tests (attainment and language) were used in the beginning as pre-tests and in the end as post-tests. For gathering information about the process during the course, observation was used and supported by the record cards. However, the interview method helped in finding the overall reactions of those involved in the course (both teachers and pupils).

From the pilot trial, observation, interviews and record cards, a great deal of information was gleaned with regard to improvement of the language of the hearing impaired, which was an important point in the present study. The qualitative methods provided a basis for the language test in the field trial to investigate the language improvement using quantitative methods,

Therefore, by making use of both quantitative and qualitative data, a broader view of the effects of the course was achieved.

VI Checking the System

The investigator wished to check whether the system was still working or not, by answering questions such as:

- Were the materials printed and sent to other schools?
- Were the teachers involved in the present study still following the new methods?
- Was there any new unit written? *etc*...

Letters were sent to the Centre of Hearing Impaired, requesting information about the above questions, but no reply was received.

2. Conclusions

I Provisions for Hearing Impaired Children in Iraq

As has been previously stated, in Iraq special schools are relatively ignored. Although Act No.126 in 1980 intended to improve resources for these pupils, no change has occurred in the teaching strategies used in special schools. However, special schools require more specific curricula and teaching methods; this is undoubtedly an area for major change if special schools are to have a significant role to play in the future (Brennan, 1982).

In general, nationally produced courses and materials tend to be more radical than those developed by teachers themselves and there is some evidence that teachers tend to impose their own philosophy and pedagogy on them (Nicholls, 1983).

The mathematics and science course 'Fractions, Plants and Magnetism Units' was developed as a response to specific needs which arose in the special schools for hearing impaired children, as mentioned before, *e.g.*, a need for learning materials and new teaching methods which can develop the knowledge and language of hearing impaired children.

II The Administration System in Iraq

In a centralised system, senior officers (for example, head of the organisation of the handicapped, director of the Centre of the Hearing impaired, and inspectors) require headmasters to use the new method in their schools and consequently the teachers have to use that method, If the teachers are interested in this method, this will affect the pupils in a positive way and if the pupils' reaction is positive, this would be reinforcement for the teacher - this is the system in Iraq.

In the present study the teachers themselves wanted to change the existing old method for the new one, as well as the senior officers, which helped in the success of the method. Since the teacher was interested in this method, it affected their pupils positively and their reaction was encouraging and consequently the method is going to be used.

The centralised system has the advantage of getting ideas and feedback, of being able to make decisions, with a great deal of authority and being able to back up those decisions with appropriate supporting finances and personnel (Centre for Education Research and Innovation, 1969). However, the difficulty of this kind of system lies behind obtaining the agreement of senior officers which takes a long time.

III Dissemination and Diffusion

The people who were in charge of the schools of hearing impaired children wanted to change the system. An education system cannot adapt itself to such a new teaching strategy in mathematics or science unless there is at least some current dissatisfaction with the old teaching strategy and ideas for replacing it. Innovation takes root and success by encouraging and reinforcing what is already found in the system (Centre for Education Research and Innovation, 1969).

If innovation is to succeed, the system which it is trying to change must be involved. Therefore it was tried in the pilot school after adapting materials nad methods for Iraqi special schools had taken into consideration the following: Arabic language, politics, culture and other factors which affected the content of the materials and the teaching methods. At first, the trials did not define strictly the dissemination strategy. However, the majority of the diffusion and dissemination events were a result of these trials.

Diffusion is defined by Kelly (1978) and Huppert (1982) in a general sense as referring to the spread of materials, ideas, values, attitudes and behaviour, related to the school curriculum, from one location to another. The term dissemination is used by the same authorsin connection with the strategy by which it is intended that the innovation be passed on.

One dissemination goal was to recruit trial teachers (see pilot trial and field trial) and to train these teachers to participate in the present study. At this stage we wanted to inform the teachers about the new teaching strategy (learning materials and teaching methods). The other goal of dissemination, was writing a new learning unit. The 'Animals Unit' arose from the pupils and their teacher. This example on dissemination and diffusion is presented below as a case study.

- An example of dissemination and diffusion: fifth grade at the pilot trial school

There were 8 pupils in this grade, 5 boys and 3 girls. Three of them aged 10 years and the others were 11 years old. Average hearing loss was 70.38 dB, with standard deviation of 5.45. The pupils's parents' education level ranged between illiterate and university graduate. Three of the pupils were hearing impaired at the age of two and the others after that age. The main cause of their impairment was childhood illness, just one was caused by a car crash (see Table No. 82),

Table 82 Information about the pupils at the fifth grade at the pilot trial school

No. of Pupil	Parents' education level Father	Mother	Cause of impairment	Age (months)
1 boy	illiterate	illiterate	whooping cough	29
2 boy	secondary school	primary school	mumps	24
3 boy	primary school	can read and write	measles	31
4 boy	middle school	middle school	car crash	43
5 boy	university	middle school	jaundice	28
6 girl	university	primary school	measles	34
7 girl	secondary school	illiterate	measles	27
8 girl	can read and write	can read and write	mumps	30

The teacher who wrote the new unit 'Animals Unit' for the fifth grade at the pilot trial school has been a teacher at that school for two years. Nevertheless, she is unqualified for teaching, since she graduated from the language department of the College of Arts. She was not involved in the pilot trial and only had a vague idea about what happened.

The material consisted of two main topics and twelve sub-headings (see Appendix 27 'The Material in English and Microfiche for Arabic Material). The material was checked by the headmaster and two of the teachers at the same school who were involved in the pilot trial.

The investigator had a chance to observe the pupils once and to ask the teacher and the pupils about their opinion of the unit. The teacher was interested in teaching the pupils to understand the subject more by an easier method than the old method. She said that the pupils enjoyed learning by the new strategy and therefore the pupils helped to produce the material by explaining how it looked and showing their last year's notebooks. They also talked about the network and cartoon, but the teacher did not understand what they meant by these. The only difficulty faced was that associating practical work with this unit.

The pupils said that they enjoyed working in this way last year more than this year, because there was no network this year and there was no practical work as last year, to help them understand this unit well. They also said that they lacked group work which had helped them to improve their language by talking to each other. However, they said that they learnt many new words by this method, over the traditional method.

The observation revealed that the teacher gave the pupils freedom to speak with each other. The pupils, as the investigator observed, discussed the questions before answering them. Some of the pupils brought some pictures of different insects and showed them to the teacher and to the other pupils. Then they stuck them in their note-books. Some of the pupils explained the lesson in front of the class, which helped them to speak.

The teacher gave the pupils only a rough idea about the lesson and she helped them individually and tried to correct their notebook every day, but did not have a record card for each pupil to record her notes. This unit lasted three weeks, consisting of four forty minute lessons.

From this new unit 'Animals Unit' it was conclused that both teachers and pupils in these schools supported and had enthusiasm for the new method. The study was affected less than other studies by the 'Hawthorn effect'. The pupils were the main means of diffusion.

Writing a new unit gives an impression that the new teaching strategy 'the innovation' is a success and that teachers change their role easily, which finding is confirmed by Spector (1984, p.573). In summary 'change strategies designed to address the effect of an innovation on a teacher as seen from the teacher's own perspective have potential to increase the success of an innovation'.

- Further examples of dissemination

The Centre of the Hearing Impaired sent one teacher from those who were trained in the new strategies to train teachers in the North of Iraq. Some teachers from the South and middle parts of Iraq presented in-service training lessons to their colleagues, which were led by teachers from those who had been trained. The Centre of the Hearing Impaired organised the typing of the materials of the units and sent them to the various schools involved in other parts of Iraq.

This was a good example of the diffusion and dissemination which took place and of the success of the innovation which was tried out in Baghdad.

Grass *et al.* (1971) suggested that the difficulties of changing the system arise because of:

1) The teachers' lack of clarity about the proposal;
2) their lack of skills and knowledge to carry it out;
3) the unavailability of necessary materials and equipment;
4) the existence of organisational materials and equipment; and
5) the lack of staff motivation.

There were no difficulties apart from the fact that some of the teachers lacked the skills and knowledge to demonstrate the work, but they were told to ask the investigator for help. This suggests that to train teachers for these methods, it is also necessary to teach them the content of the units.

In addition, all schools are lacking laboratories and equipment. The teachers work in the classrooms and supplied the equipment in the field trial to those classes, which gave the impression that the teachers were motivated and had a positive attitude towards the innovation, although this was not measured.

The present innovation was therefore more acceptable than other methods, as Rowntree (1982, p.235) said, 'in general, the less disruptive it is to on-going practices and teacher attitudes, the more chance an innovation has of being adopted'.

IV <u>Teacher Training</u>

One way of influencing the curriculum of the schools is to radically alter the nature of teachers' training in Iraq, so that a better education for the hearing impaired pupils may be provided.

In Iraq, as mentioned before, teachers for the hearing impaired are not always trained before they start teaching in these schools, or even for teaching in ordinary primary schools. Sometimes they are trained for 7-10 days or less, within their work.

The Warnock Report (1978) recommended that an element concerned with special educational needs should be formed with special educational training courses and indicated some of the contents of such an element. Courses of initial teacher training already include instruction in teaching methods and forms of classroom organisation to promote effective learning. Almost all teachers of hearing impaired children in the UK have special training in their work as this is a legal requirement for work in this area of disability (Brennan, 1982), (Maher and Bennett, 1984). Fish (1985) stated that the initial training of teachers of the hearing impaired has to include remedial education in addition to teaching methods and forms of classroom organisation.

There were two main areas of in-service training - the training of all qualified teachers in post about special educational needs and provision, and the specialist training of those qualified teachers who are to staff the new range of arrangements for children with disabilities and significant difficulties (Fish, 1985).

The innovation which was applied to hearing impaired children in Iraq gave a change for some of the teachers to be trained, as mentioned before, and in addition, at the end of 1983 the Ministry of Labour and Social Affairs recommended that teachers of the hearing impaired should be trained before they take up their posts. A three months course was therefore established for training teachers. Although the course was of short duration, at least the Ministry had started to improve the qualifications of the teachers, suggesting the Ministry had noticed the needs of the hearing impaired. (The investigator suggests some subject matter and length of time required for in-service and initial teacher training for the future in Appendix 28.) In the middle of 1984 a committee was formed of members of the Ministry of Labour and Social Affairs and the Ministry of Education, with the aim of improving the teaching methods in these schools, taking into consideration the new method discussed in this thesis, which had been applied to the hearing impaired.

3. Recommendations

The findings and discussion in this study suggest the following recommendations for future research in this area:

(i) Extension of the research

- The same study should be conducted in another part of Iraq. The findings of the replication should then be compared with those of this study.
- The same study may be conducted in another Arabic country. The findings of the replication should then be compared with those of the Iraqi study.

(ii) Language test

- The same language test should be carried out on a larger sample of normal hearing, in order to obtain more accurate results.
- A comparison study of the function of the language (*e.g.*, verb, adverb, punctuation....)between normal hearing and hearing impaired children should be followed.
- Finding out the reasons behind the improvement of language of some grades more than others in the experimental group is worth following up.
- A follow-up study of interaction between pupils and teachers should be carried out (teachers talk) and (pupils talk).

(iii)Teaching

- Teachers should be trained in measuring the hearing degree as well as in teaching methods and knowledge of subjects.
- A follow-up study using the new method with normal hearing children.

- A follow-up study to ascertain which method is best for improving the language and knowledge of hearing impaired children.

(iv) Attitude, motivation, social adjustment, memory

- An attitude questionnaire should be distributed to teachers.
- A follow-up study of teachers' motivation for using the new teaching strategy should be carried out.
- Similarly, a study of pupils' motivation should be carried out.
- A study should be done to measure the social adjustment of hearing impaired children before and after using the new methods.
- Similarly, a study to measure the memory of hearing impaired children should be carried out.

(v) Development study

- Other units could be designed in other areas of currricula.
- Using other resource-based learning (*e.g.*, television, video, tapes...) for teaching the new units.
- A standardised test of readability for different ages.

(vi) Study implication

- This study might be followed up by a design of a profile of the children, including the record card.
- The children's IQ and HD should be re-tested more regularly.
- The Ministry of Labour and Social Affairs and the Ministry of Health recommended (in early 1984) a follow-up study on early testing of the hearing of all children.

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APPENDICES

/Cont...

APPENDICES (cont.)

Appendices contained in the Wallet

APPENDIX I

THE HEARING TEST

There are two categories of hearing test: (1) screening tests and (2) diagnostic tests.

(1) Screening Tests

Distraction test (or screening test) between 6-18 months

A test is given to all children in the UK when they are able to sit up. The testing technique used is distraction audiometry. It requires two health visitors, or two skilled practitioners, one of whom distracts the child with a simple toy, while the second gets behind the child. The practitioners then follow a structured set of activities. In between activities, the first practitioner will distract the child. The second practitioner will take a new position, moving as quietly as possible and making sure his/her shadow does not fall across the child. He/she moves right and left behind the child, at a distance of about 3 feet and makes sounds. When the second practitioner is in action, the first practitioner will sit quietly, avoiding eye contact with the child. All sounds made are deliberately made at minimal level.

The sounds made are high and low frequency. High frequencies are emitted by a device called a rattle, or by voice making the sound of the letter 's'. Low frequencies use the sound of the letter 'o'. The sounds are reported below:

twice to the right) HIGH
twice to the left)

twice to the right) LOW
twice to the left)

Any child failing to pass these tests is sent for a full audiological and medical examination (using diagnostic tests as described below) to find the degree of hearing loss and the type of deafness.

A co-operative test between 18-30 months

All children are tested for checking purposes. Children who are tested at this age are able easily to ignore the distraction type of test, so use is made of the normal hearing child's growing understanding of spoken language. Relation is gained by playing with some toys with the child and then the assessor moves into a routine of asking the child to do things with the toys in response to very quietly spoken commands, *e.g.*, with a 'bus and 'play people', the child would be asked to 'put the man in the bus', give 'one to Mummy', 'put one on the table', *etc.* Simple sentences such as these would be spoken very quietly at a distance of 3 feet from each ear.

The child's ability to hear high frequencies would be tested as in the distraction test, using the high frequency rattle or the high frequency consonant 's'. The child's ability to locat sounds at distance is checked using a chime bar or other noise maker. The child's attention is first drawn to some toys, so that he cannot anticipate where the test sound is being produced.

A performance test between 30-40 months

By the time the child is around two and a half years old, he is usually able to wait, listen for a sound signal and make a response. The assessor frequently uses a wooden boat, which has positions for eight men to sit. The assessor often starts the test using the mother. "Mummy, you listen and when I say 'go', you put the man in the boat...go!" Then the child's mother demonstrates and the child imitates. 'Go' test low frequency. The signal is again given very quietly at 3 feet from the ear, and out of vision of the child. The high frequency signal is the consonant 's' and the child responds again by performing some action each time the signal is given.

(2) Diagnostic Tests

As previously mentioned, diagnostic tests are used to determine the level of hearing loss and the type of loss at the earliest possible moment, so that the child can make use of his residual (remaining) hearing as effectively as possible with a hearing aid.

Pure tone audiometry

When the child reaches the age of 3-3½ years, the pure tone test of hearing will be attempted. This test is very similar in format to the performance test. However, in the pure tone test, the child is conditioned to respond to a whistle of a particular frequency, rather than to 'go' or 's', as in the performance test. Initially, using a portable audiometer, the clinician will demonstrate to the child what he is expected to do. The audiometer produces tones in the speech frequency range 250-4000 Hz. The child is conditioned (or trained) to 'put a man in a boat' or 'a ball in a box' each time he hears a tone. Once the clinician has satisfied himself that the child is capable of waiting until a tone is produced before completing the task, he will proceed to the pure tone audiometric test.

The test involves the child wearing a pair of headphones, which are connected to the audiometer. Each ear is tested separately and the child's hearing thresholds are measured for a number of different pure tone frequencies in the speech frequency range. The threshold is the level of the quietest signal the child can hear. The information from this test tells the clinician what the child's hearing levels are and how they compare with the normal population. The test using the headphones is known as a test of pure tone audiometry for air conduction. This means that it is a measure of the child's total hearing.

Another test that employs the same procedure, from the child's point of view, is the test of pure tone audiometry for bone condition. In this test, a small vibrator is placed on the mastoid bone behind one ear. Pure tones, the same as those used for headphone testing, are directed from the audiometer to the bone vibrator on the mastoid. New hearing threhsolds for these signals are measured and recorded.

The electroacoustic impedance bridge

This machine provides the clinician with much valuable information on whether a child has a conductive component in the hearing loss. The machine tells the clinician whether the middle ear is functioning normally. The measurements made are objective (the test only requires the passive co-operation of the patient) and are very easy for the clinician to interpret in terms of normality or abnormality,

The electroacoustic impedance bridge is able to measure how much sound is reflected from the ear drum and therefore how efficient the middle ear mechanism is at passing sound to the nerve of hearing. With this information, the clinician can decide whether or not a conductive loss is present. In the clinics at Manchester, the test is used routinely on children from a few months old and few children object so violently that the test cannot be carried out. Once this information has been obtained, the clinician will consider it together with other information obtained during the clinical session and then come to a decision about the future management of the child.

Hearing for speech tests

While the child's hearing for pure tones, as in the pure tone audiometric tests, is very important in a diagnostic sense, it is important to gain some information about the child's ability to hear speech. Hearing people speak is surely one of the most important functions of our hearing. The speech test for hearing which will be applied to a child will depend primarily on the child's age and language level.

One of the tests which can be carried out on very young children is the Kendall Toy Test. The group of children for whom this test has proved most suitable is the performance age test, that means children of 2½ years or more.

As the child gets older, it is possible to carry out more sophisticated speech tests of hearing, where the child has to listen to a word and pick out the appropriate item from a group of items in a picture. Such a test is the Manchester Picture Test. Later still, the child may be asked to listen through headphones.

APPENDIX 2a

Examples of the Proposed Materials

TASK CARD 5

Magnetic Poles

You will need: Item E

What to do

1. Write a heading in your notebook "MAGNETIC POLE".

2. Read item E.

3. Copy the question which is at the bottom of page 2 of item E and then answer it.

Item E

Every magnet has two poles. The two poles are different. One pole is called the North pole or the North-seeking pole. The other pole is called the South pole or the South-seeking pole. Therefore, every magnet has a North and a South pole.

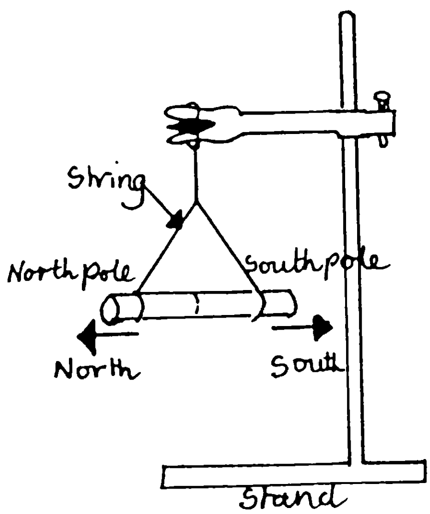
If a magnet is allowed to hang freely it will always hang in a certain direction - the North-South direction.

The North pole will always point towards the North and the South pole will always point towards the South.

This is why the North pole is known as the North-seeking pole and the South pole is known as the South-seeking pole.

Experiment 2

Hang a magnet so that it can rotate freely in the air, as shown in the diagram below. When the magnet stops moving, mark the direction of



the magnet with a piece of calk. Mark one pole with a cross. Move the magnet to another position and release it. When the magnet finally stops rotating, note the direction of the pole with a cross.

Has it come back to the former position?

TASK CARD 1 Plants

What is the importance of plants for human beings?

1. Feeding

   To investigate the importance of plants for human beings (Feeding)

You will need: Item A

What to do

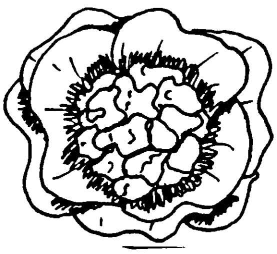
1. Write a heading in your notebook "Feeding".
2. Read pages 1 and 2 of item A.
3. Prepare a list of some kinds of Foods you get from plants.
4. Answer, in complete sentences, the two questions at the bottom of page 2 of item A.

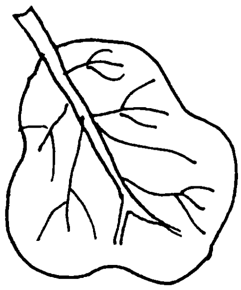
Item A

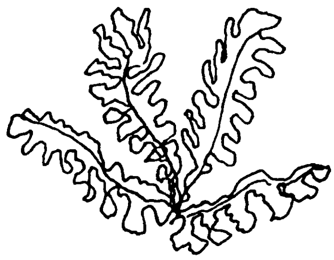
There are many kinds of food you can get from plants. Some of them contain (seeds, stems, leaves, roots or fruit).

Wheat, beans, barley are seeds. Carrots are roots. Potatoes are stems. Parsley and cabbage are leaves. Cauliflower is flower.

Draw these pictures in your notebook, then colour them and label them.







However, do you know that meat, for example, which you eat, also comes from plants? Meat comes from cows, sheep and goats which all eat plants. If there were no plants there would be no cows, sheep or goats,

Plants, therefore, are the only living things that can make their own food, and they themselves become food for other living things.

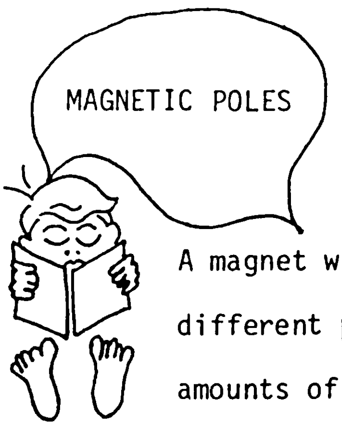
Do you remember (answer each question with a complete sentence)

1. Plants are important to you as.................................

2. What part of parsley, cabbage and spinach are eaten...........

APPENDIX 2b

Examples of the Materials after Reviews

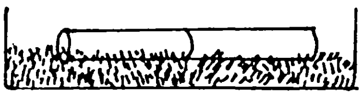


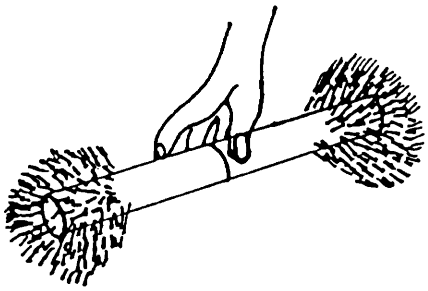
A magnet will attract magnetic substances. However, different parts of a magnet will exert different amounts of magnetic force.

The two ends of a magnet will exert greater amounts of magnetic force than the other parts of a magnet. The middle of the magnet will exert the least force. The two ends of the magnet are called the POLES. If you want to be able to prove it, you will need:

a. magnet
b. clips or iron filings

Procedure: Dip a magnet in paper clips or iron filings. You will find that most of the clips or iron filings will be attracted to the poles of the magnet.





This experiment shows that the ends or poles of the magnet have greater magnetic force than the centre. As you can see, few iron filings or paper clips will be attracted to the middle position.

Copy this question in your notebook and then answer it with your friend.
Do you know why few paper clips or iron filings were attracted to the middle portion of the magnet?

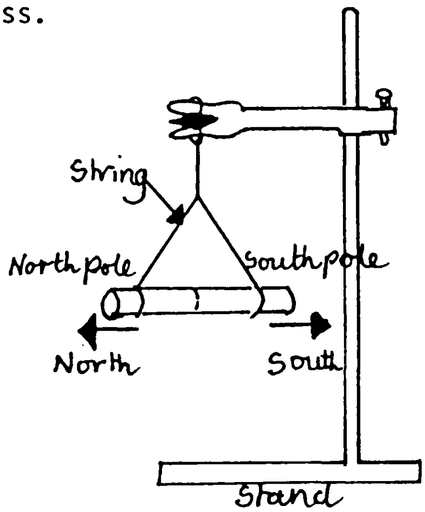
Every magnet has two poles. The two poles are different. One pole is called the North pole. The other pole is called the South pole. Every magnet has a North and a South pole.

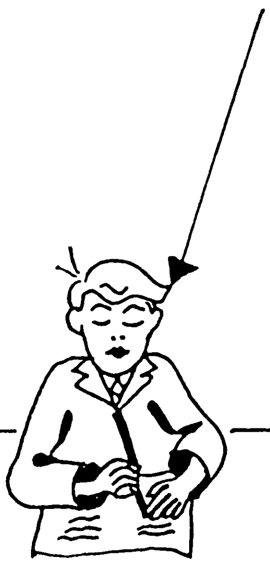
If a magnet is allowed to hang freely it will always hang in a certain direction - the North-South direction.

The North pole will always point towards the North and the South pole will always point to the South. You can find this out for yourself when you do this experiment. Work with your friend. You will need:

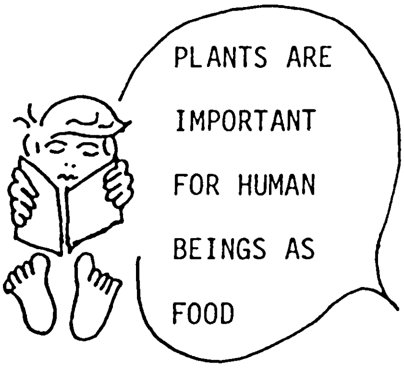
a. magnet
b. string
c. stand

Procedure: Hang a magnet so that it can rotate freely in the air, as shown in the diagram below. When the magnet stops moving, mark the direction of the magnet with a piece of chalk. Mark one pole with a cross. Move the magnet to another position and release it. When the magnet finally stops rotating, note the direction of the pole with a cross.



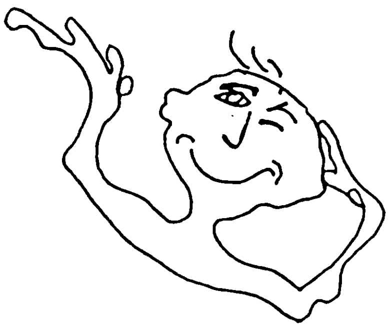


Has the magnet come back to the former position? Write your conclusion in your notebook. Work with your friend.

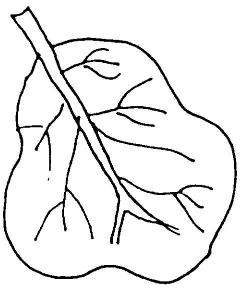


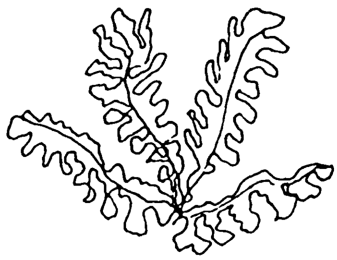
There are many kinds of food you can get from plants. The parts of plants that are eaten can be: seeds, stems, leaves, roots or fruit.

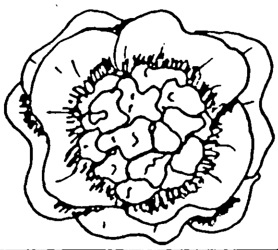
For example, what, beans, barely are seeds; carrots are roots; potatoes are stems; parsley and cabbage are leaves; cauliflower is a flower.



Draw these pictues in your notebook, then colour and label them.

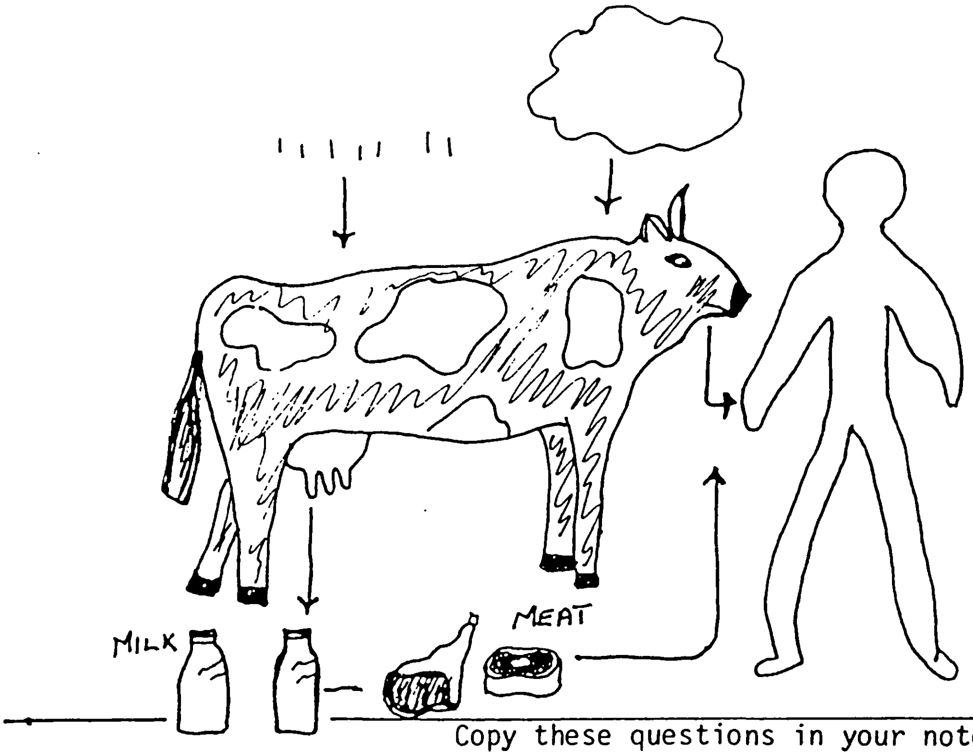






Do you know that meat which you eat also comes from plants? Meat comes from cows, sheep, goats, which all eat plants. If there were no plants, there would be no cows, sheep or goats.

Plants, therefore, are the only living things that can make their own food, and they themselves become food for other living things.



Copy these questions in your notebook and then answer them in a complete sentence:

a. an important source of food for humans........

b. what part of parsley, cabbage and spinnach are eaten.......

Prepare with your partner a list of some kinds of food which you get from plants.

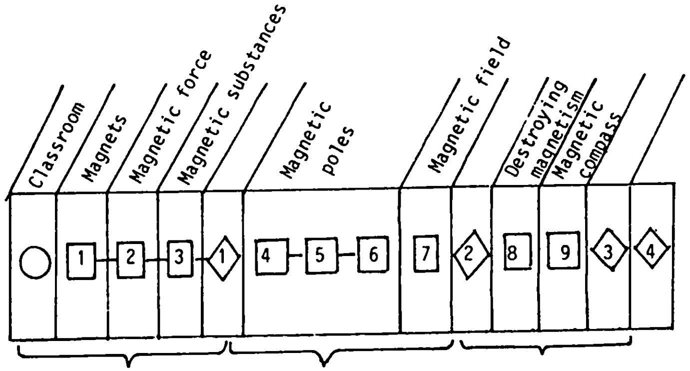
APPENDIX 3a

1. Master Sheet - Magnetism

MASTER SHEET

Learning Activities

Network:



Part 1	Part 2	Part 3
Resources	Resources	Resources
A Magnets	D Magnetic poles	H Destroying magnetism
B Magnetic force	E Magnetic poles	I Magnetic compass
C Magnetic substances	F Magnetic poles	
	G Magnetic field	
Test 1	Test 2	Test 3

○ class activity □ individual ◇ test

Test No.4 = mastery learning

Analysis of Learning Activities (Task card)

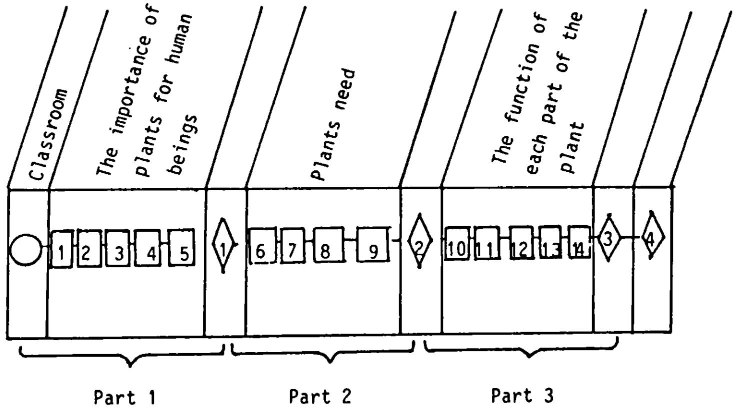
No.	Synopsis	Difficulty	Involves experimental work	Objectives: knowledge and comprehension	Objectives: observation/ measurement	Objectives: Interpretation	Objectives: Application/ problem solving
	Class lesson						
1	Magnets						
2	Magnetic force						
3	Magnetic substances						
4	Magnetic poles						
5	Magnetic field						
6	Destroying magnetism						
7	Magnetic compass						

2. Master Sheet - Plants

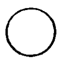
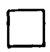
MASTER SHEET

Learning Activities

Network:



A	Feeding	F	Water	J	Root
B	Clothing	G	Air	K	Branch
C	Building	H	Light	L	Leaves
D	Heating	I	Temperature	M	Flower
E	Other advantages to plants			N	Seeds
	Test 1		Test 2		Test 3

 class activity  individual  test

Test 4 = mastery learning

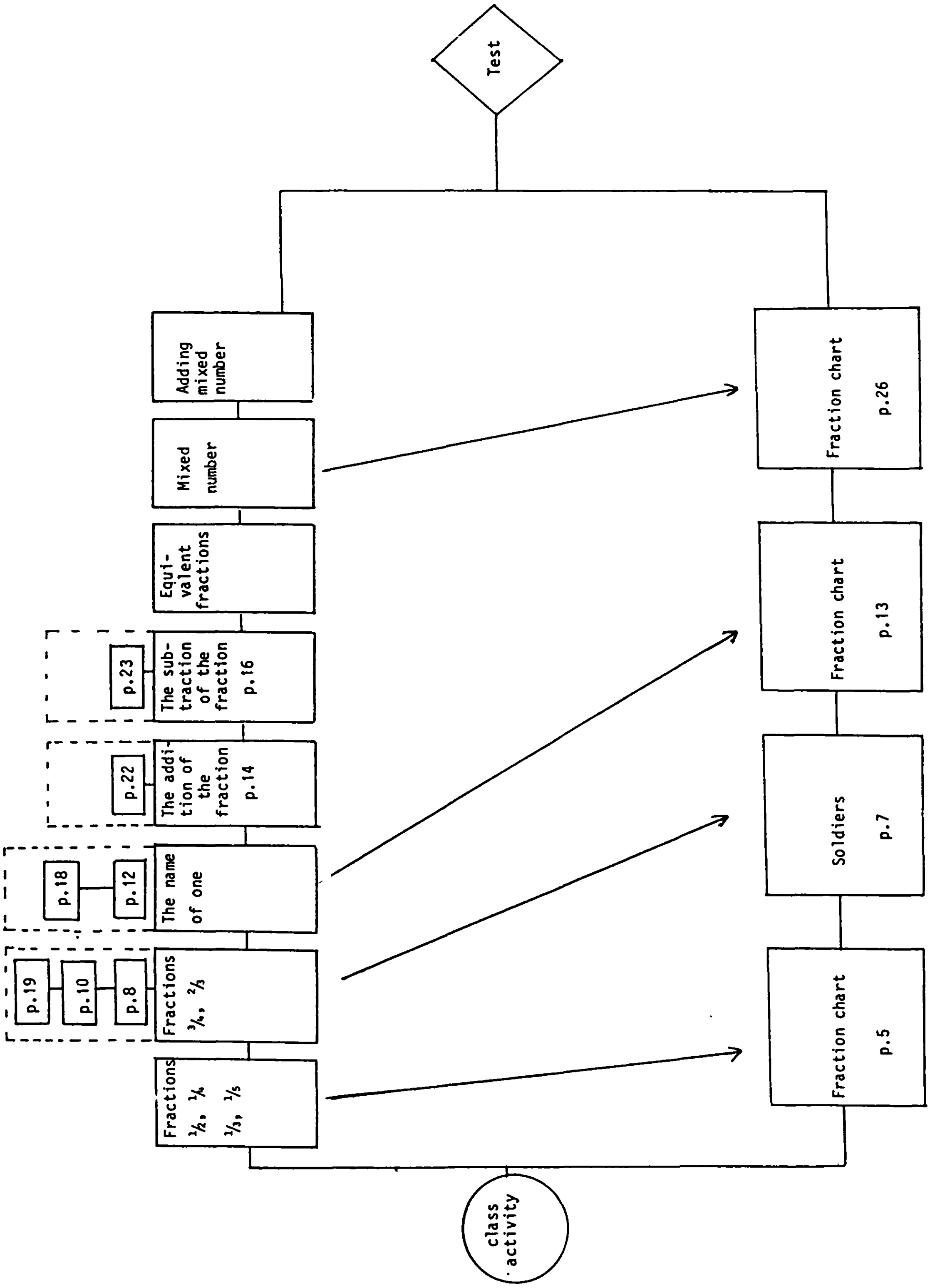
Analysis of Learning Activities (Task Cards)

No.	Synopsis	Difficulty	Involves experimental work	Objectives: knowledge and comprehension	Objectives: observation/ measurement	Objectives: interpretation	Objectives: application/ problem solving
	Class lesson						
1	Feeding						
2	Clothing						
3	Building						
4	Heaging						
5	Other uses from plants						
6	Water						
7	Air						
8	Light						
9	Temperature						
10	Root						
11	Branch						
12	Leaves						
13	Flower						
14	Seed						

APPENDIX 3b

Teacher's Guide in English and the Arabic Language

1. Teacher's Guide to the Fractions Unit



Network of 'Fraction Unit'

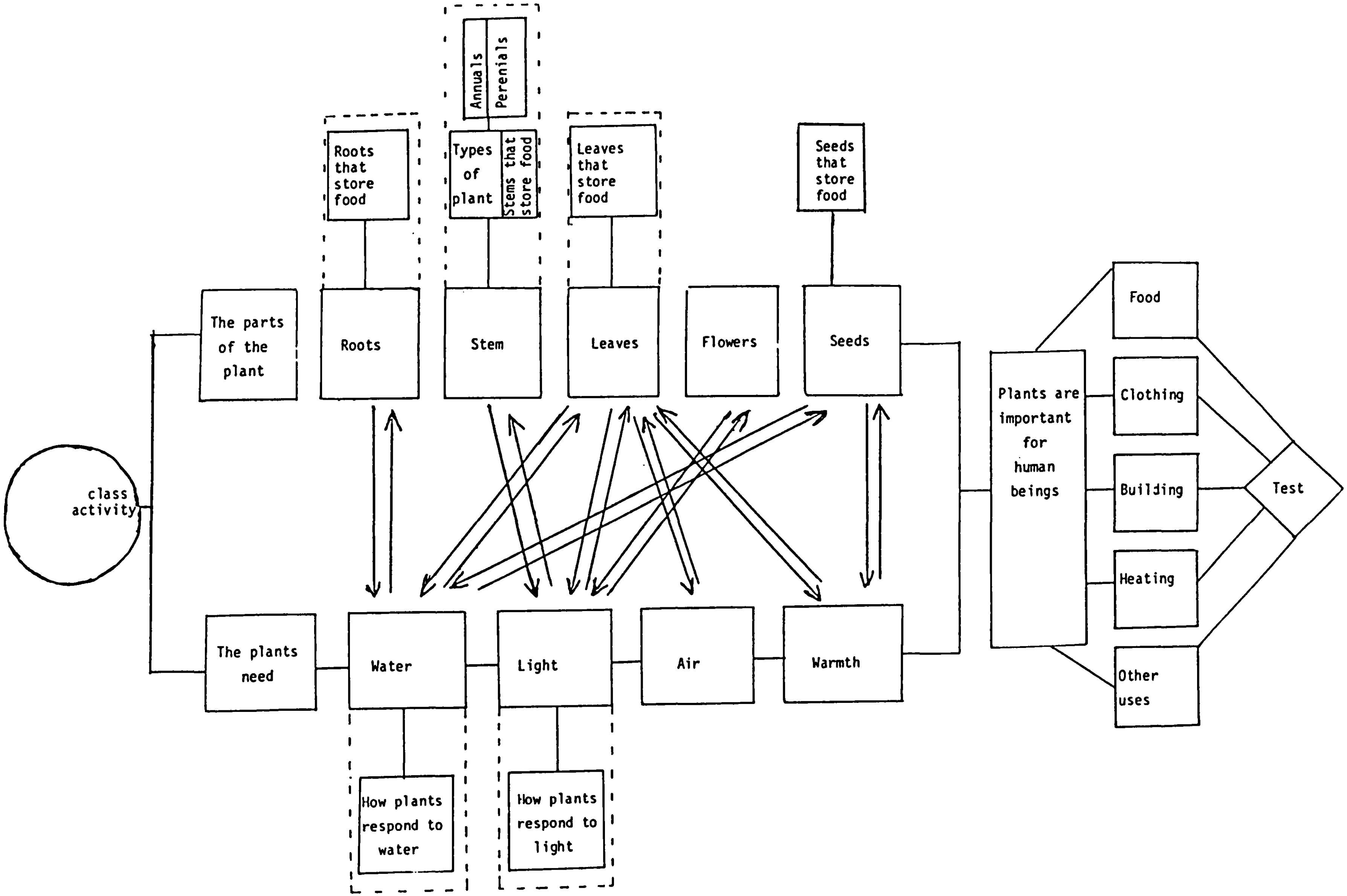
Detailed notes for teachers - 'Fractions Unit'*

Content	Purposes - to help pupils to be able to:	Pupils' Activity	Teacher's Notes	Unit requirements
Fractions $\frac{1}{2}$ Fractions $\frac{1}{4}$ Fractions $\frac{1}{3}$ Fractions $\frac{1}{5}$ A fraction chart Fractions $\frac{3}{4}$, $\frac{2}{3}$ Soliders Group Coloured and non-coloured group The name of one A fraction has many names The addition of fractions The subtraction of fractions All these mean 1 Fractions of coloured part Equivalent fractions Addition of the fraction Subtraction of the fraction Mixed number A fraction chart	- read, write and talk; - draw and label; - recognise that the concept of a fraction implies dividing something into a specified number of equal parts; - explain that the fractional part may be part of a unit; - explain that the fractional part may be part of a group; - identify the denominator; - identify the numerator; - explain that there is no one definite shape for $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and so on; - explain the addition of the fractions; - explain the subtraction of the fractions; - recall the way for finding equivalent fractions; - selection of a correct answer; - identify what are mixed numbers; - explain how to add the mixed numbers; - identify the relation between fractions and numbers; - develop an interest in studying fractions.	Answer the questions in each sheet. Do practical work. Like cutting out shapes alone and with a friend. Explain some practical example. Draw and colour shapes. Label shapes.	As an introduction: Explain to the class how they will work with these sheets; activity (group, individual and whole class). Explain lessons in practical way to the pupils, then ask them some questions. Tour the room, making sure that the pupils spend the time in the correct way. Help pupils who have difficulty in understanding, as they need more explanation. Mark the answers of 5he questions for the pupils and record the scores on their record cards.	Worksheets

*Each category is a separate unit - do not read across the table.

Equipment:	Colour pencil
	Cards
	Paper
	Glue
	Scissors

2. Teacher's Guide to the Plants Unit



The network of the 'Plants Unit'

<u>The Explanation</u> [the pupil studies either (a) or (b) of each section]

1. (a) roots → water → how plants respond to water → roots that store food

   (b) Water → roots → how plants respond to water → roots that store food

2. (a) Stem → light → how plants respond to light → types of plants → stems that store food

   (b) Light → stem → how plants respond to light → types of plants → stems that store food

3. (a) Leaves → water → light → air → warmth → leaves that store food

   (b) Water → light → air → warmth → leaves → leaves that store food

4. (a) Flowers → seeds → how plants respond to light

   (b) Light → flowers

5. (a) Seeds → water → warmth → seeds that store food

   (b) Water → warmth → seeds → seeds that store food

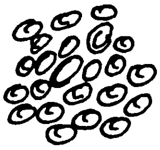
Then he/she can study: plants are important for human beings.

Detailed notes for teachers - 'Plant Unit'*

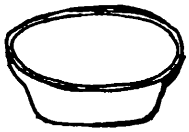
Content	Purposes - to help pupils to be able to:	Pupils' Activity	Teacher's Notes	Unit requirement
The parts of the plant: a. roots b. stem c. leaves d. flowers e. seeds The plant needs: a. water b. light c. air d. warmth Types of plants: a. annuals b. perennials Plants are important for human beings: a. food b. clothing c. building d. heating e. other uses.	- read, write and talk; - identify the part of plants; - explain the function of each part of a plant; - observe the parts of plants and seeds through growth; - recognise that plants are living things; - discuss why plants are living things; - discuss why plants need water, light, air, warmth; - identify two types of plants: (annuals and perennials); - describe each type of plant; - explain the importance of plants in our life; - recall how plants are important - do experiments using plants; - prepare annotated diagrams of plants; - develop an interest in agriculture,	Answer the questions in each sheet. Do some experiments with his/her friend Discuss the conclusion of some experiment with the teacher. Prepare lists about some sort of seeds, roots, stem, tree, *etc.* Draw pictures of some plants, parts of plant, seeds through their growing, *etc.* Label some kinds of plants. Colour some shapes.	As an introduction: Explain to the class how they will work with these sheets; tests; activity (group, individual, whole class). Do some of the experiments in front of the class and discuss with them. Tour the room, making sure that the pupils spend the time in the correct way. Answer quick questions from the pupils. Help pupils who have difficulty in reading and understanding, so they need more explanation to prove the point. Allow the pupils to work in the garden sometimes. Mark the answers to the questions for the pupils and record the scores on their record cards.	Worksheets

*Each category is a separate unit - do not read across the table.

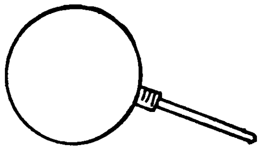
Equipment



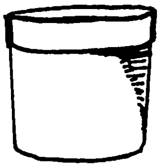
seeds



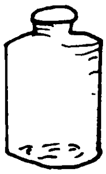
bowl



magnifying glass



flower pot



glass container

ink

cotton

soil

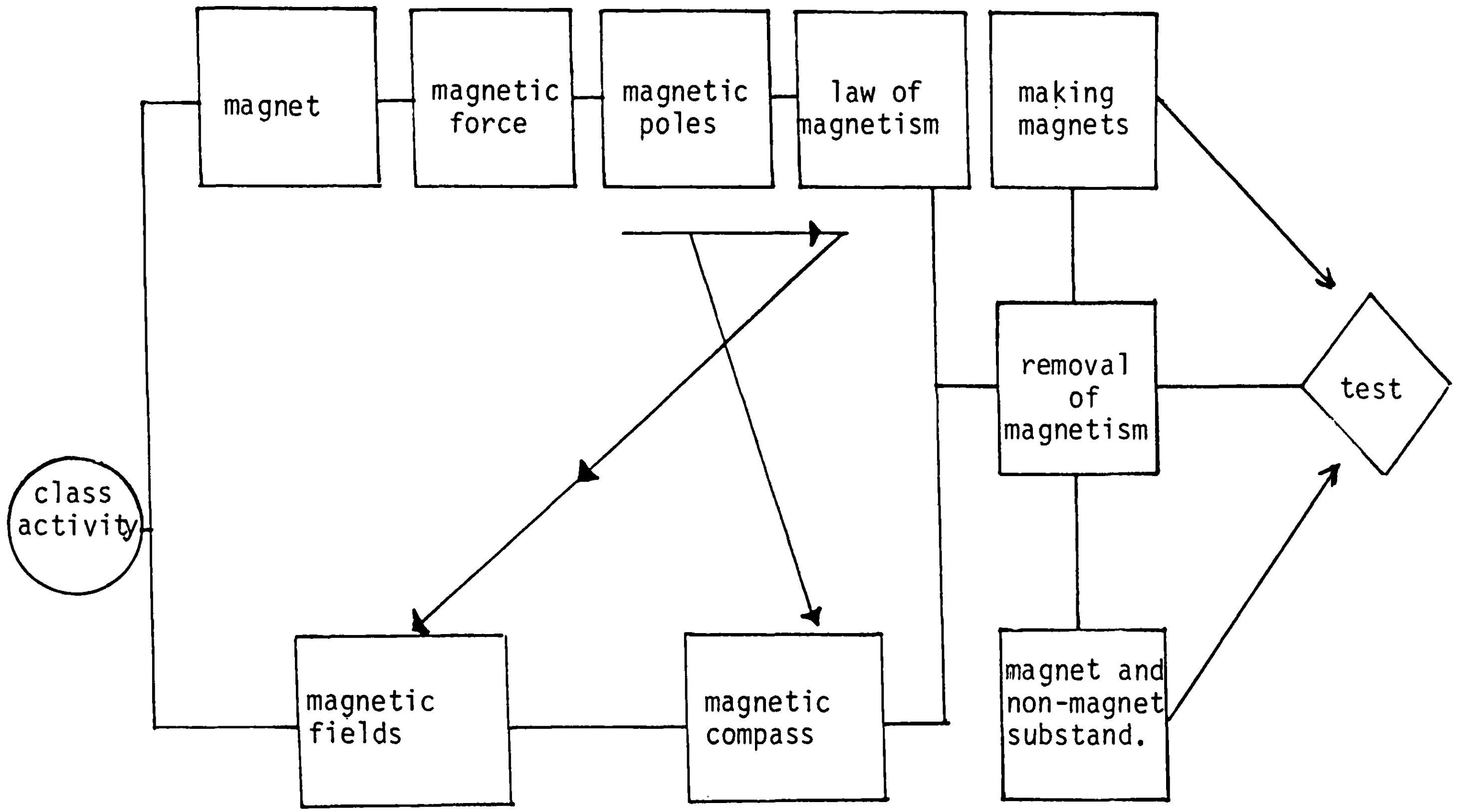
tea

piece of cloth

Glossary (Plants Unit)

Carbon dioxide	Gas, without colour, test, or smell, produced by animal bodies and breathed out by animals.
Cell	A very small part of plants. If you want to see it, you have to see it under a microscope.
Magnifying glass	Lens to make something appear larger.
Mammal	Any of the class of animals which feed their young with milk from the breast.
Oxygen	Gas without colour, taste, or smell present in the air needed all forms of life.
Raw materials	Like cloth made from cotton, so cotton raw materials.
Root hairs	Provide the main absorbing region of the root. They are tiny. They grow out from the cells and between the soil particles. This helps to keep the soil firm round the roots and reduces erosion by wind and rain.
Saturate	Make very wet.
Starch	White, tasteless, food substance, found in potatoes, grain, *etc.*

3. Teacher's Guide to the Magnetism Unit



The pupils can study: magnetic poles ⟶ magnetic compass

magnetic poles ⟶ law of magnetism ⟶ magnetic fields

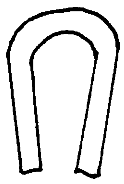
Network of Magentism Unit

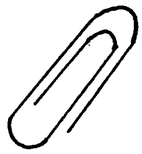
Detailed notes for teachers - 'Magnetism Unit'*

Content	Purposes - to help pupils to be able to:	Pupils' Activity	Teacher's Notes	Unit requirement
Magnet	- read, write and talk;	Answer the questions in each sheet.	As an introduction:	Worksheets
Magnetic force	- identify characteristics of magnets;	Do some experiments with his/her friend.	Explain to the class how they will work with these sheets; tests; activity (group, individual, whole class).	
Magnetic and non-magnetic substances	- do experiments using magnets;	Discuss the conclusion of some experiments with the teacher.	Do some experiment in front of the class and discuss it with them.	
Magnetic poles	- prepare annotated diagrams of magnets;	Draw some pictures which relate to the unit.	Tour the room, making sure that the pupils spend their time in the correct way.	
The law of magnetism	- identify the magnetic and non-magnetic substances;	Label some shapes.	Answer quick questions from the pupils.	
Magnetic fields	- explain magnetic force;		Help pupils who have difficulty in doing some experiment.	
Making magnets	- recall the law of magnetism;		Mark the answers to the questions for the pupils and record the scores on their record cards.	
Destroying magnetism	- acquire the skill of how to magnetise some iron objects;			
Magnetic compass	- acquire the skill of how to remove magnetism;			
	- recognise how to find directions;			
	- develop an interest in the unit.			

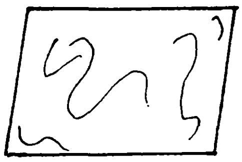
*Each category is a separate unit - do not read across the table.

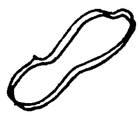
Equipment


magnet


paper clip

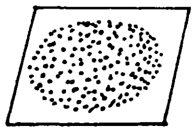

drawing pins


wooden board

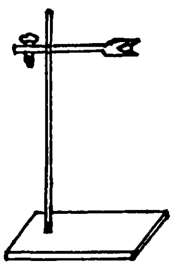

rubber band


iron nail


plastic basin


iron filings


steel knitting needle


stand

paper

string

Glossary (Magnetism Unit)

Attract	Pull towards.
Compass	Device with a needle that points to the magnetic north.
Destroy	Make useless.
Field	Area or space in which force can be felt.
Magnetic field	Round a magnet.
Permanent	Not expected to change, going on for a long time.
Pole	North/south magnetic pole, either of the two points near the north or south poles to which the compass needle points.
Repel	Push away.
Temporary	Lasting a short time only.

Record Card

Name: Class: Unit:

Date Task Comments

Test

Pre:

Post:

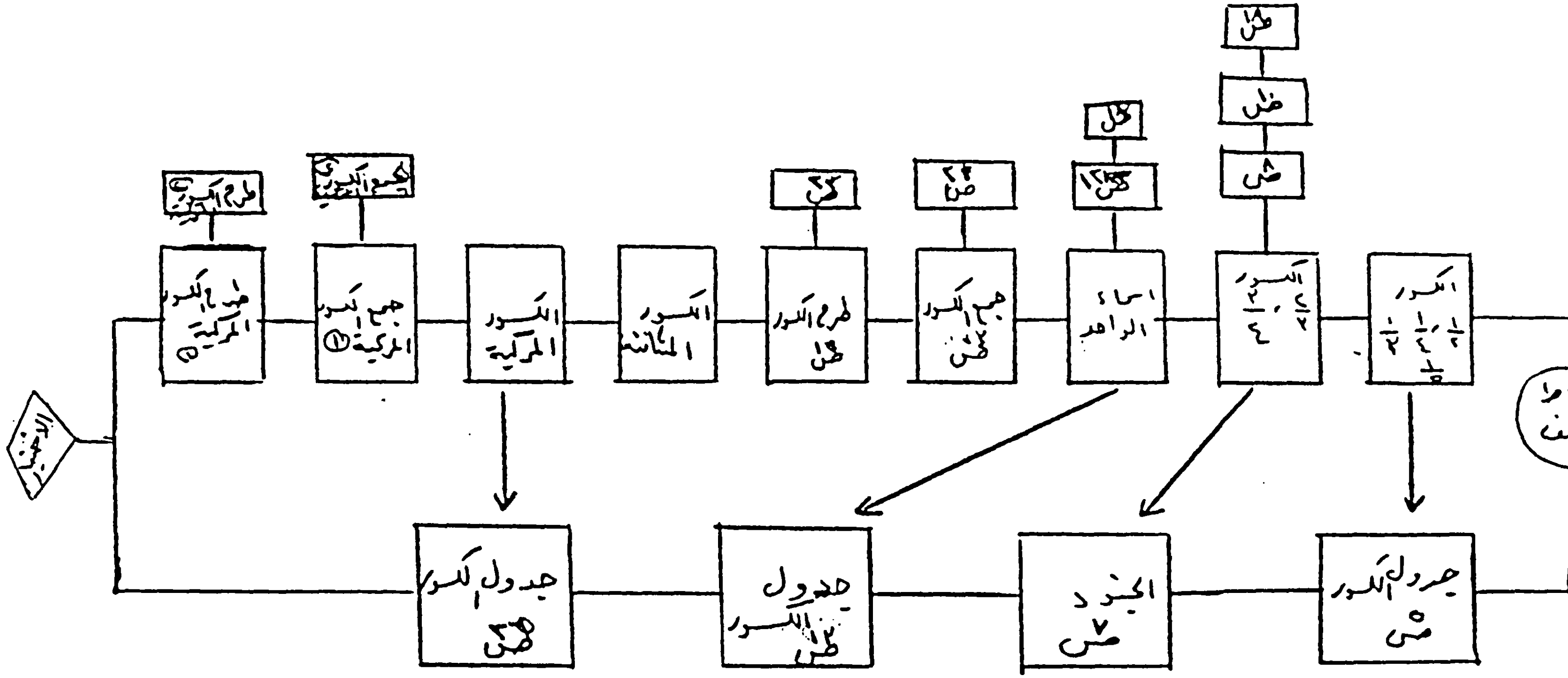
No. of sheets 1 2 3 4 5 6 7 8 9 10 ....

دليل المعلم

Teacher's guide

In Arabic Language

١- دليل المعلم لوحدة الكسور



الطالب يدرس :- الكسور مثلا $\frac{1}{2}$ ، $\frac{1}{3}$ ، $\frac{1}{4}$ ، $\frac{1}{5}$ ثم يدرس جدول الكسور ص . وهذا بالنسبة الى الاخرى .
) ← يجب ان يدرس ... فليس وجوب على كل طالب ان يدرسها .
الفروع المتفرعة من المربعات الاساسية هي اصعب .

- مخطط العمل لوحدة الكسور -

المحتوى .	الأهداف مساعدة الطلبة للقدرة على:	نشاط الطلبة	ملاحظات للمعلمة .	متطلبات الوحدة.
الكسر $\frac{1}{2}$ الكسر $\frac{1}{3}$ الكسر $\frac{1}{4}$ الكسر $\frac{1}{5}$ جدول الكسور الكسور $\frac{2}{4}$ ، $\frac{2}{2}$ الحدود الميمونة المنطقة الملونة وغير الملونة أسماء الواحد للكسر عدة أسماء جمع الكسور ① طرح الكسور ① كل هذه الكسور تسمى واحد كسر الجزء الملون الكسور المتكافئة جمع الكسور ② طرح الكسور ② الكسور المركبة جدول الكسور جمع الكسور المركبة .	• القراءة ، الكتابة والتحدث ، • الرسم ، التسمية ، • تميز ان مفهوم الكسور يعني تقسيم الشيء إلى عدد معين من الأجزاء المتساوية ، • شرح ان جزء الكسور قد يكون جزء من وحدة ، • شرح ان جزء الكسور قد يكون جزء من مجموعة ، • تحديد مقام الكسر ، • تحديد بسط الكسر ، • توضيح انه لا يوجد شكل قائم للـ $\frac{1}{2}$ ، $\frac{1}{3}$ ، $\frac{1}{4}$ الى آخره ، • شرح جمع الكسور ، • شرح طرح الكسور ، • تذكر طريقة ايجاد الكسور المتكافئة ، • اختيار الإجابة الصحيحة ، • تحديد ماهية الكسور المركبة ، • شرح كيفية جمع الكسور المركبة ، • تحديد العلاقة بين الكسور والاعداد ، • تنمية الميل لدراسة الكسور .	• الإجابة عن الأسئلة في كل ورقة . • قم بعمل تطبيقي كقطع أشكال سيفردله أو مع صديقه . • ارسم ولون بعض الاشكال . • اذكر اسماء بعض الاشكال . • قم بشرح بعض الأعمال التطبيقية التي انتهيت من عملها .	• كمقدمة اشرح للصف كيفية التعامل مع الادوات ، الاختبارات ، الفعاليات (كميونة ، كفرد ، كصف كامل) . • اشرح الدرس للطلبة بصورة تطبيقية ثم وجه بعض الأسئلة للطلبة . • قم بجولة في الصف للتأكد بأن الطلبة يتصرفون وفهمهم بصورة صحيحة . • ساعد الطلبة الذين لديهم صعوبات بالفهم لانهم يحتاجون إلى شرح مطول . • راقب الطلبة خلال كل درس بعد ان تقسم الى مجاميع وسجل ملاحظاتك في الكارت الخصوصي . • صحح اجابات الطلبة على الأسئلة وسجل درجاتهم في كارت التسجيل .	١ ٢ ٣ ٤ ٥ .

ملاحظات تفصيلية للمعلمة .
"وحدة الكسور".

الاحتياجات

اقلام اصباغ

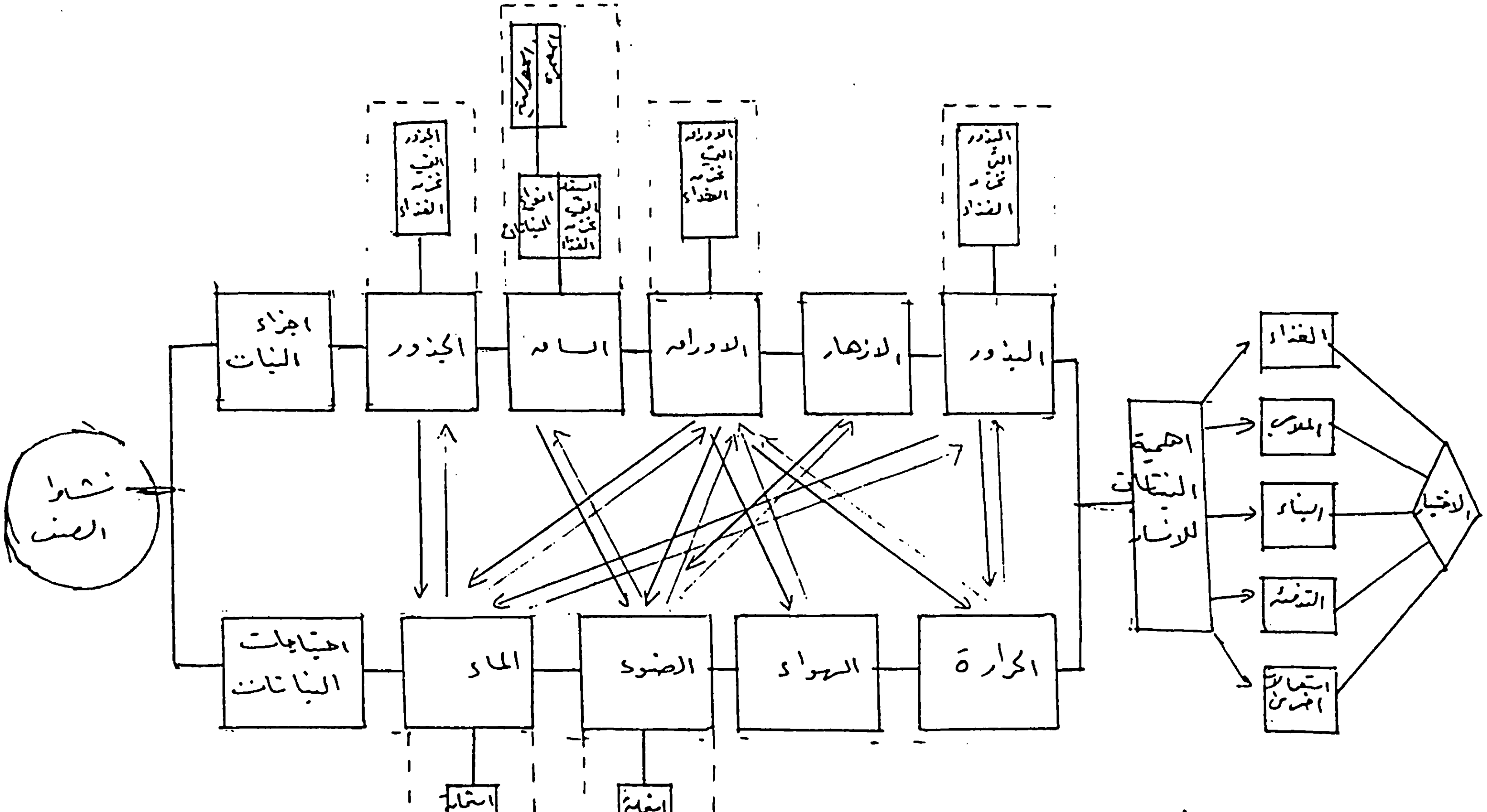
كارتون

اوراق

صمغ

مقصات

٢- دليل المعلم لوحدة النبات



مخطط العمل لوحدة النبات

شرح المخطط في الصفحة الاخرى .

الشرح

الطلاب يدرسون اما أ او ب

أ- الجذور ← الماء ← استجابة النبات للماء ← الجذور التي تخزن الغذاء

١- ب- الماء ← الجذور ← استجابة النبات للماء ← الجذور التي تخزن الغذاء

أ- الساق ← الضوء ← استجابة النبات للضوء ← انواع النباتات ← السيقان التي تخزن الغذاء

٢- ب- الضوء ← الساق ← استجابة النبات للضوء ← انواع النباتات ← السيقان التي تخزن الغذاء

أ- الاوراق ← الماء ← الضوء ← الهواء ← الحرارة ← الاوراق التي تخزن الغذاء

٣- ب- الماء ← الضوء ← الهواء ← الحرارة ← الاوراق ← الاوراق التي تخزن الغذاء

أ- الازهار ← البذور ← استجابة النبات للضوء.

٤- ب- الضوء ← الازهار.

أ- البذور ← الماء ← الحرارة ← البذور التي تخزن الغذاء

٥- ب- الماء ← الحرارة ← البذور ← البذور التي تخزن الغذاء.

وبعد ذلك يمكن دراسة : اهمية النباتات للانسان.

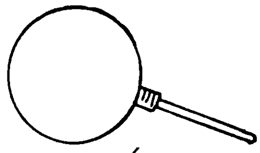
المحتوى	الأهداف مساعدة الطلبة للقدرة على:	نشاط الطلبة.	ملاحظات للمعلمة.	متطلبات الوحدة
١- اجزاء النباتات أ- الجذور ب- الساق ج- الاوراق د- الازهار هـ- البذور ٢- احتياجات النباتات أ- الماء ب- الضوء ج- الهواء د- الحرارة ٣- انواع النباتات أ- الحولية ب- المعمرة ٤- اهمية النباتات للانسان أ- للغذاء ب- الملابس ج- البناء د- التدفئة و- استعمالات اخرى.	• القراءة، الكتابة والتحدث، • تحديد اجزاء النبات، • شرح وظيفة كل جزء في النبات، • مراقبة اجزاء النبات والبذور اثناء النمو، • تمييز ان النبات كائن حي، • شرح لماذا تحتاج النباتات الى ماء، ضوء، هواء، حرارة، • تحديد نوعين من النبات، الدائمة والفصلية، • وصف كل نوع من النبات على حدة، • توضيح اهمية النبات في حياتنا، • تذكر اهمية النباتات كمصدر للغذاء، • عمل بعض التجارب باستعمال النباتات، • عمل رسم بياني للنباتات مع التسمية، • تنمية الميل للاهتمام بالزراعة.	• الاجابة على الاسئلة بشكل ورقة • عمل بعض التجارب مع صديقه. • مناقشة نتائج بعض التجارب مع المعلمة. • اعداد قائمة ببعض انواع: البذور، الجذور، السيقان، الاشجار... الى آخره. • رسم صور لبعض: النباتات، اجزاء النبات، البذور خلال نموها... الى آخره. • تسمية بعض انواع النباتات. • تلوين بعض الصور.	• كمقدمة، اشرح للصف كيف يعملون مع: الدوائر، الاختبارات، النشاط (مجموعة، انفرادي، الصف ككل). • اعمل بعض التجارب امام الصف. وناقشها معهم. • تجول في الصف لتتأكد بأن الطلاب يصرفون وقتهم في الطريق الصحيح. • اجب على الاسئلة القصيرة بسرعة للطلاب • ساعد الطلاب الذين عندهم صعوبة في القراءة، والفهم ويحتاجون الى شرح اكثر باستخدام بعض الدلائل. • اسمح للطلاب بأن يعملوا بالحديقة بعض الوقت. • لاحظ الطلاب في كل درس، وبعد ان تقسم مجموعات، وسجل ملاحظاتك في الكارت المخصص. • صحح اجابات التلاميذ وسجل الدرجات في الكارت المخصص.	

ملاحظات تفصيلية للمعلمة -
وحدة النباتات،

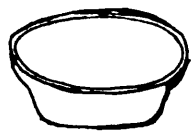
معاني الكلمات

الكلمة	معناها
ثاني اوكسيد الكاربون	غاز ، بدون "لون، ذوق ورائحة" يطرح من المخلوقات .
الخلية	جزء صغير جدا من النبات . لا يمكن ان تراه بالعين المجردة الا باستخدام المكروسكوب .
المكبرة	عدسة لتكبير الاشياء .
اللبائن	اي صنف من الحيوانات التي تغذي صغارها حليب من الثدي .
الاوكسجين	غاز بدون" لون، ذوق ورائحة" موجود في الهواء، كل المخلوقات الحية تحتاجه ؛
المواد الاولية	مثال : القماش يصنع من القطن، فلذلك القطن يعتبر مادة اولية .
الشعيرات الجذرية	شعيرات صغيرة جدا موجودة في جذر النبات، وهذه الشعيرات تثبت النبات في التربة .
ترطب	اجعله مبلل جدا
النشا	مادة غذائية بيضاء ، بدون طعم، موجود في البطاطا، الحبوب . . . الى اخره .

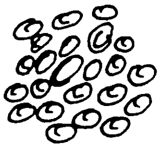
الاحتياجات



مكبرة

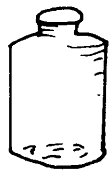


صحن

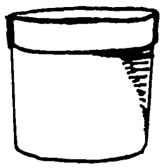


بذور

محبرة



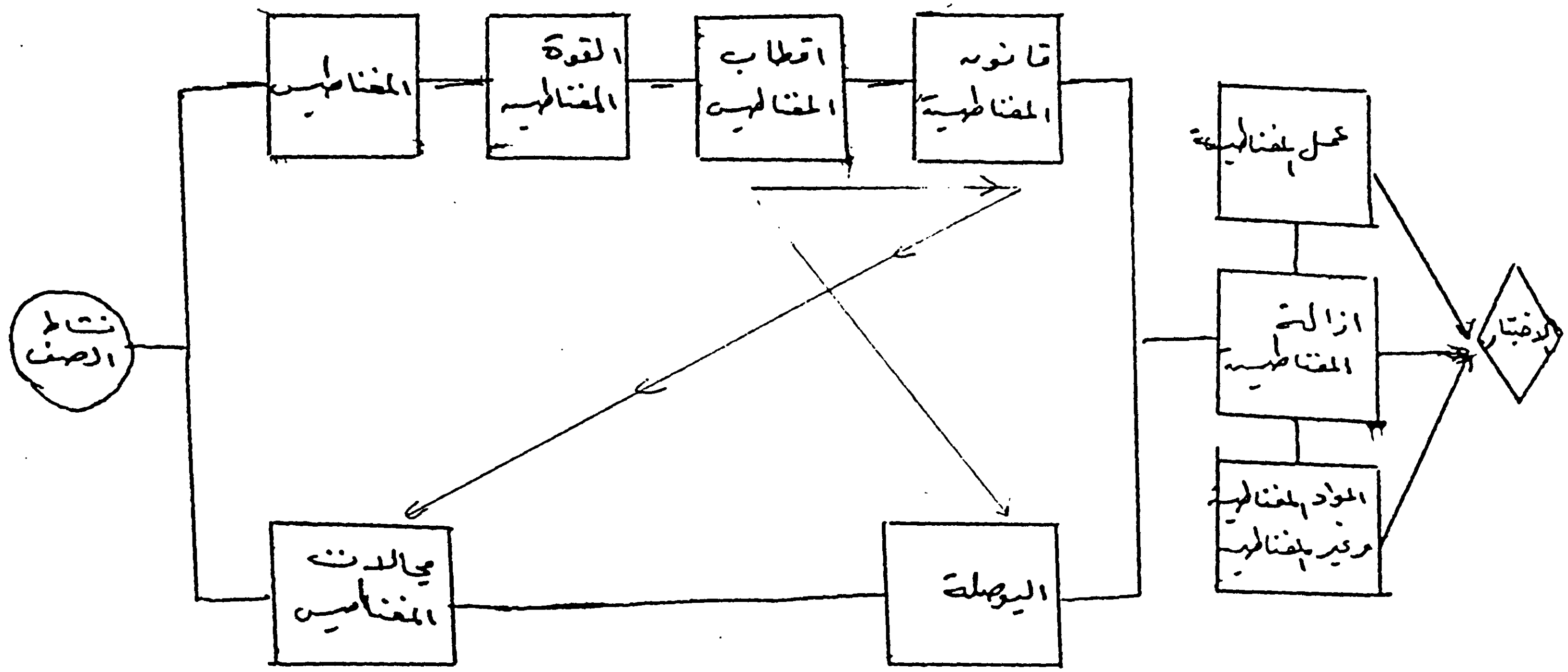
ناقوس



٢ أصيص

قطن
طين
شاي
قطعة قماش

٢- دليل المعلم لوحدة المغناطيسية



الطلاب يتمكنون من دراسة :
- اقطاب المغناطيس ← البوصلة
- اقطاب المغناطيس ← قانون المغناطيسية
مجالات المغناطيس

- مخطط العمل لوحدة المغناطيسية -

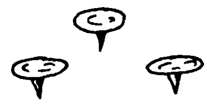
المحتوى	الأهداف مساعدة الطلبة للقدرة على:	نشاط الطلبة.	ملاحظات للمعلمة.	متطلبات الوحدة
المغناطيس التأثير المغناطيسي المواد المغناطيسية وغير المغناطيسية. أقطاب المغناطيس قانون المغناطيس مجالات المغناطيسية عمل المغناطيسية ازالة المغناطيسية البوصلة .	• القراءة ، الكتابة ، التحدث ، • تحديد صفات المغناطيس ، • عمل تجارب باستعمال المغناطيس ، • عمل رسم بياني للمغناطيس مع التسمية ، • تحديد المواد المغناطيسية وغير المغناطيسية ، • شرح القوة المغناطيسية ، • تذكر قانون الجذب ، • اكتساب مهارة كيفية عمل مغناطيس من المواد الحديدية ، • اكتساب مهارة كيفية ازالة المغناطيسية • تمييز كيفية ايجاد الاتجاهات الاربعة باستعمال المغناطيس ، • تنمية الميل لهذه الوحدة .	• الاجابة على الاسئلة الموجودة في كل ورقة. • عمل بعض التجارب مع مدرسه. • مناقشة استنتاجات بعض التجارب مع المعلم . • رسم بعض الصور التي تتعلق بالوحدة . • تسمية بعض الاشكال.	• تقدم مدرسة الشرح للصف كيفية العمل مع الدوائر ، الاختبارات ، النشاط (مجموعة ، انفرادي ، الصف كله) . • عمل بعض التجارب امام الصف ، و مناقشتها معهم . • تحرك في الصف للتأكد من ان الطلبة يسيرون وفقهم بالشكل الصحيح • اجيبي على الاسئلة المفيدة للطلبة . • مساعدة الطلبة الذين عندهم صعوبة في عمل التجربة . • لاحظي الطلبة في كل درس بعد ان تقسمهم كمجموعات وسجل ملاحظاتك في السجل بعد تصحيح الاسئلة.	[illegible]

ملاحظات تفصيلية للمعلمة .
وحدة المغناطيسية ،

معاني بعض الكلمات

الكلمة	معناها .
البوصلة	اداة وفيها ابرة تشير الى القطب الشمالي المغناطيسي .
التجاذب	يسحب باتجاه معين .
التجاذب الدائم	ليس من المتوقع تغيره ويستمر لفترة طويلة .
القطب	القطب المغناطيسي : الشمالي - الجنوبي ويكونان اما ذا تخطين ترسين من القطب الشمالي او القطب الجنوبي والذي تشير اليه ابرة البوصلة .
المجال المغناطيسي	ما يحيط بالمغناطيس
المؤقت	يستمر لفترة قصيرة .
ينفر	يدفع خارجاً .

الاحتياجات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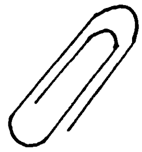
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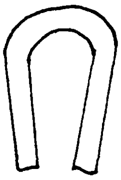
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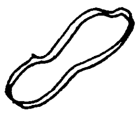
مسمار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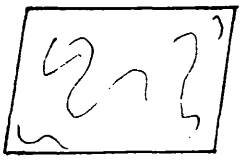
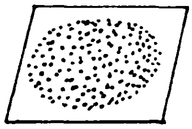
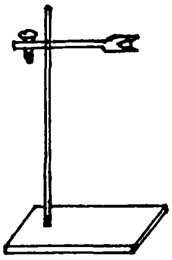

لوحة خشبية .


صنارة حياكة
(استيل)


برادة حديد


حوض بلاستيك


مسند

اوراق
خيوط .

<u>كارت التسجيل</u>

الاسم :		الصف :		الوحدة :

<u>التاريخ</u>		<u>الدرس</u>		التطبيقات

الاختبار

القبلي

البعدي

رقم الادوار ١ ٢ ٣ ٤ ٥ ٦ ٧ ٨ ٩ ١٠ - - . . .

APPENDIX 4

The Validation Group of the Learning Materials

(A) The validation group in the UK

- Teacher at primary school (PHU)
- Teacher at secondary school (PHU)
- Teacher of mathematics at secondary school
- Research officer

(B) The validation group in Baghdad, Iraq

- Director of handicapped centre
- Three school inspectors of hearing impaired schools
- Three experienced teachers at hearing impaired schools
- A specialist in curriculum design for primary schools

APPENDIX 5

The Results of the Validation Groups

(A) The UK validation groups

The teacher for hearing impaired children at primary school mentioned that you should use easy words and short sentences for hearing impaired pupils at that age, and it needs a glossary for some words. Teachers must be used to practical work in mathematics and science when they explain these lessons. Other teachers of hearing impaired children at secondary school also confirmed this. However, in addition, it was stated that using geometric chapes are better than using other shapes. This was also confirmed by other members of the validation group and in the literature relating to this subject.

(B) The validation groups in Iraq

After the materials had been translated into Arabic, it became apparent that the same problems existed in this language. Therefore, the recommendations of the Iraq validation group were to use simple words, short sentences and a glossary for some words.

APPENDIX 6

The 'Fractions Unit' was defined for the fourth, fifth and sixth grades as follows:-

A) Fractions unit for the fourth grade:

- fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$
- fractions $\frac{3}{4}$, $\frac{2}{3}$.
- the name of one
- the addition of the fractions

B) Fractions unit for the fifth grade:

- fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$
- fractions $\frac{3}{4}$, $\frac{2}{3}$
- the name of one
- the addition of the fractions
- the subtraction of the fractions
- equivalent fractions

C) Fractions unit for the sixth grade:

- fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$
- fractions $\frac{3}{4}$, $\frac{2}{3}$
- the name of one
- the addition of the fractions
- the subtraction of the fractions
- equivalent fractions
- mixed numbers
- the adding of mixed numbers

APPENDIX 7

Analysis of the Questions in the Worksheets in the Three Units

Fractions Unit

Number of worksheets	Number of questions	Type of learning
1	1	Individual
2	1	Individual
3	1	Individual
4	1	Individual
5	2	Individual
6	1	Group
7	1	Individual
8	2	Individual
9	2	Individual
10	2	Individual
11	2	Group
12	1	Individual
14	5	Individual
16	4	Individual
17	1	Individual
18	1	Group
20	2	Group
21	2	Group
23	2	Group
24	2	Individual
25	1	Individual
26	5	Individual

Plants Unit

Number of Worksheets	Number of questions	Type of learning
1	1	Individual
2	1	Group
3	1	Individual
4	2	Group
5	1	Group discussion
6	-	-
7	1 1	Individual+discussion with teacher
8	2	Individual
9	1	Group
10	2	Ineividual
11	1	Individual
12	-	-
13	2	Individual
	1	Group discussion
14	1	Group
	11	Individual
15	1	Individual + discussion with teacher
16	1	Group discussion
	1	Individual
17	-	-
18	1	Individual + discussion with teacher
19	1	Individual + discussion with teacher
	1	Group discussion
20	1	Individual
21	1	Group
	1	Individual
22	1	Individual
	1	Group
23	1	Individual

Plants Unit (Cont.)

Number of Worksheets	Number of questions	Type of learning
24	1	Individual
	1	Group
25	1	Group
26	2	Individual
27	1	Individual + discussion with teacher
28	1	Group discussion

<u>Magnetism Unit</u>

Number of Worksheets	Number of questions		Type of learning
1	1	Individual	Individual
2	1	Gru	Group
3	-		-
4	1		Individual
	1		Group
6	1		Individual
7	1		Group
8	1		Group
9	-		-
10	1		Group
12	-		-
12	1		Group
	1		Individual
13	-		-
14	1		Group
15	1		Individual
16	2		Individual
17	1		Individual

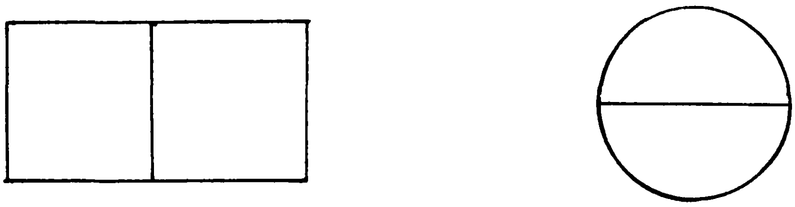
APPENDIX 8

Mathematics and science pre-tests for the three grades

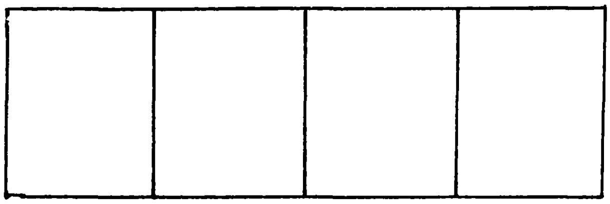
Fractions Unit Fourth Year

Pre-test

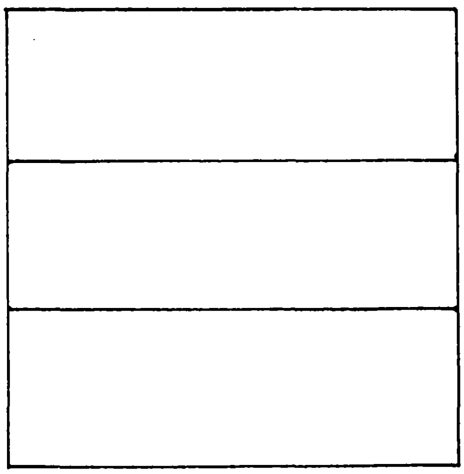
1. Draw these shapes and coloured $\frac{1}{2}$ group



2. Draw this shape and coloured $\frac{1}{4}$ group



3. Draw this shape and coloured $\frac{1}{3}$ group

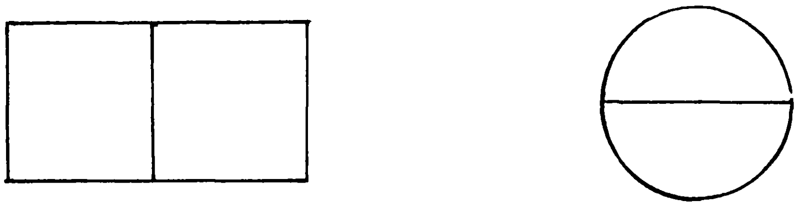


4. Add this: $\frac{1}{2} + \frac{1}{2} =$

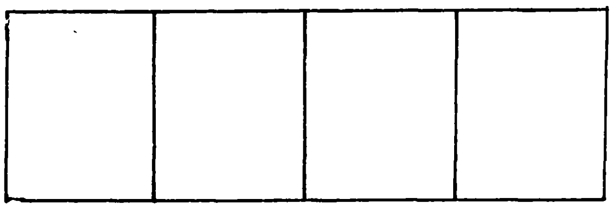
Fractions Unit Fifth Year

Pre-test

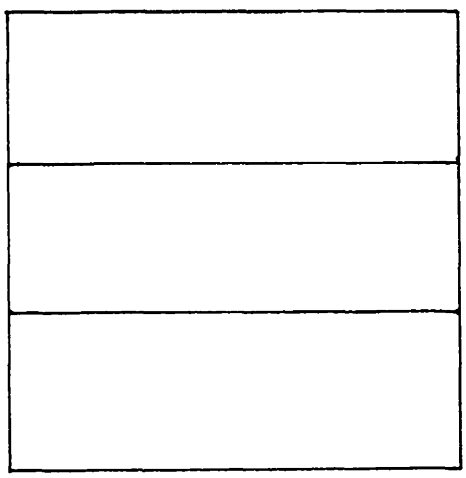
1. Draw these shapes and coloured $^{1}/_{2}$ group



2. Draw this shape and coloured $^{1}/_{4}$ group



3. Draw this shape and coloured $^{1}/_{3}$ group



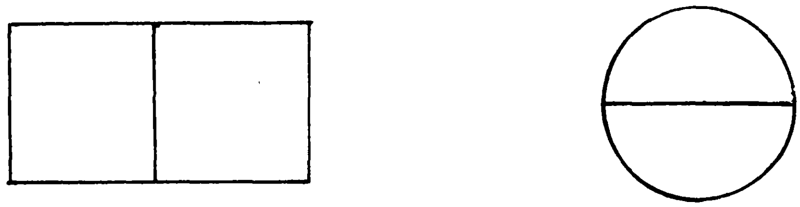
4. Add this: $\frac{1}{2} + \frac{1}{2} \ =$

5. Subtract this: $^{3}/_{4} - {}^{1}/_{4} \ =$

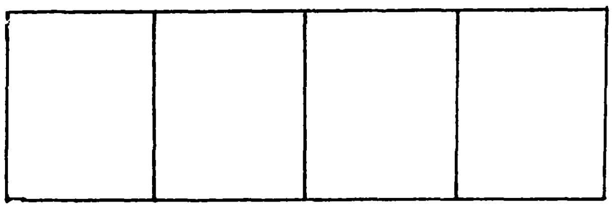
Fractions Unit Sixth Year

Pre-test

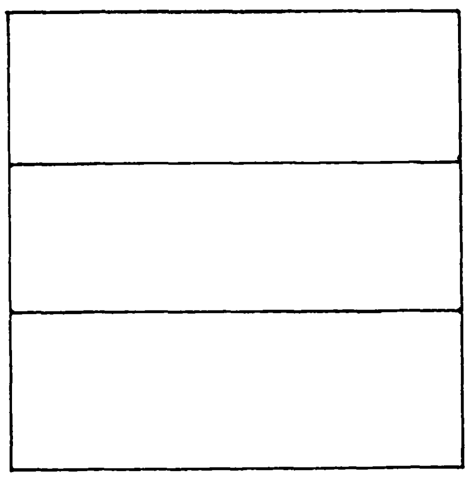
1. Draw these shapes and coloured ½ group



2. Draw this shape and coloured ¼ group



3. Draw this shape and coloured ⅓ group



4. Add this: $\frac{1}{2} + \frac{1}{2} =$

5. Subtract this: $\frac{3}{4} - \frac{1}{4} =$

6. Add this: $1\frac{2}{3} + 1\frac{1}{3} =$

<u>Pre-test</u> <u>Fourth and Fifth Grades</u> <u>Plants unit</u>

1. Name the parts of a plant

   a.............................. b.............................

   c.............................. d.............................

2. Name four things that plants need in order to grow.

   a.............................. b.............................

   c.............................. d.............................

3. Which parts of a plant can store food?

   a.............................. b..............................

   c.............................. d..............................

4. Which plarts of a plant make food for the plant?

   ....

5. How could you prove that your food originates from plants?

   ....

<u>Pre-test</u> <u>Sixth Grade</u> <u>Magnetism unit</u>

1. What is the law of magnetism?

2. Draw two different shapes of magnets and label them

3. By which ways can you change magnets back into ordinary pieces of iron or steel?

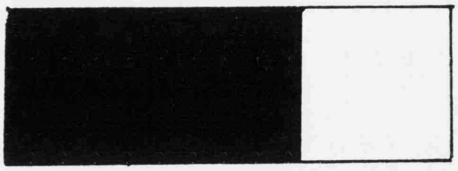
4. What is a compass used for?

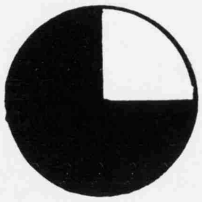
APPENDIX 9

Mathematics and science post-tests for the three grades

Post-test (Fractions unit) fourth year

1. Draw a fractions chart showing these: 1, $^1/_3$, $^1/_6$
2. Draw these shapes in your paper and then put a circle around the right fraction

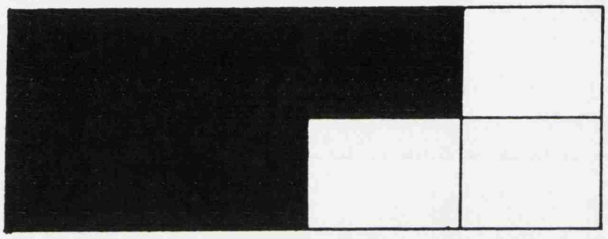




$^2/_3$, $^3/_4$, $^1/_4$

$^1/_3$, $^3/_4$, $^2/_3$

3. Draw and colour this shape in your paper and then answer

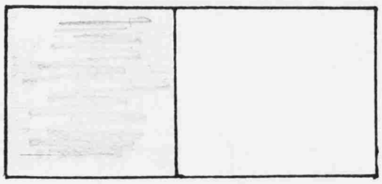


Number of the coloured parts are

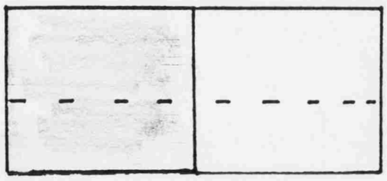
Number of all the parts are

Fraction ______ is the coloured group

4. Draw and colour these shapes then answer the questions



$\frac{1}{2}$ $\frac{\square}{4}$



5. Copy these questions in your paper and complete

$^3/_4$ + $^2/_4$ =

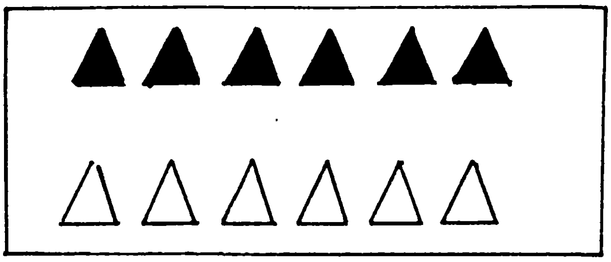
$^4/_{10}$ + $^2/_{10}$ =

Post-test (Fractions unit) Fifth year

1. Draw a fractions chart showing these:

   1, $\frac{1}{5}$, $\frac{1}{10}$

2. Copy and complete



$\frac{1}{2}$ shapes are blue

$\boxed{}$ all the shapes

$\boxed{}$ shapes are blue

$\frac{1}{2}$ the 12 = $\boxed{}$

3. Copy these questions in your paper and complete

1) $\frac{4}{7} + \frac{2}{7} = \boxed{\frac{}{}}$

2) $\frac{5}{9} + \frac{2}{9} = \boxed{\frac{}{}}$

4. Copy these questions in your paper and complete

1) $\frac{5}{8} - \frac{2}{8} =$ ________

2) $\frac{6}{10} - \frac{4}{10} =$ ________

5. Use the quick method to find three fractions equivalent to each of these.

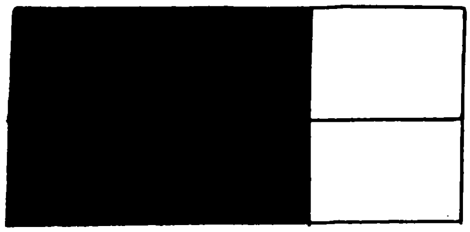
1.) $\frac{2}{3}$

2) $\frac{3}{5}$

Post Test (Fractions Unit) Sixth year

1. Draw a fractions chart showing these: 1, $\frac{1}{5}$, $\frac{1}{10}$

2. Draw and colour this shape in your paper and then answer:



Number of the coloured parts are

Number of all the parts are

Fraction ______ is the coloured group

3. A labourer finished $\frac{3}{6}$ of his work in the morning, and he finished $\frac{2}{6}$ of his work in the afternoon. How much did he finish?

4. A lorry was loaded with $\frac{5}{4}$ tons of sugar, take away $\frac{2}{4}$ ton from it. How much remains?

5. Use the quick method to find (4) fractions equivalent to each of these:

(1) $\frac{2}{3}$ (2) $\frac{3}{5}$

5. Complete these questions:

$1\frac{2}{10} + \frac{1}{10} =$ ______

$\frac{4}{5} + 3\frac{2}{5} =$ ______

Post-test Plants Unit

Fourth and Fifth Grades

1. Name two plants that store food in their roots.

   a..................................

   b..................................

2. Name four things that a leaf needs to make food.

   a..................................   b..............................

   c..................................   d..............................

3. Name four things that plants need in order to grow

   a..................................   b..............................

   c..................................   d..............................

4. In a plant what are the functions of

   a Flowers..........................   b Leaves.......................

   c Stems............................   d Roots........................

   e Seeds............................

5. Name two plants that store food in their stems

   a..................................   b..............................

6. Give two reasons why plants are important for human beings

   a............................ b..............................

7. Name the part of a plant which makes food for the plant

   ....

8. In what ways are foods such as eggs and meat developed from plants?

   ....

9. What is the difference between annuals and perennial plants?

   ....

10. In what way plants respond to the light and water?

    ....

Post-test Sixth Grade Magnetism Unit

1. Draw four different shapes of magnets and label them

2. Write down three magnetic substances.

....

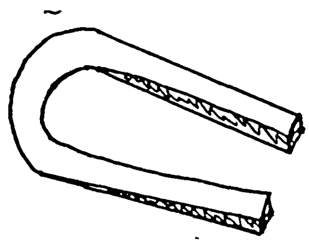
3. Write down whether the following things are magnetic or non-magnetic substances.

Pencil........................ Iron nails....................

Glass......................... Steel spoon...................

and paper.....................

4. Name the poles of this magnet



5. If a bar magnet is allowed to hang freely, in what direction will it point?

....

6. The law of magnetism states that:

1)..

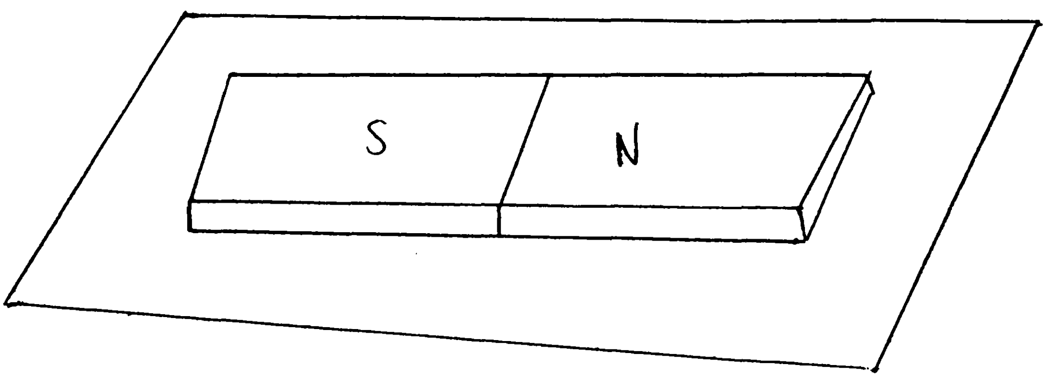
2)..

7. Write down two ways by which magnetism is removed

1)..

2)..

8. Draw the magentic field of this bar magnet



9. What is a compass used for?

....

10. What is the difference between temporary and permanent magnet?

....

APPENDIX 10

SCORING OF MATHEMATICS AND SCIENCE TESTS

The scores of all the tests were decided by the teachers and inspectors following discussion with the invesgigator and before the start of the pilot trial. Once again, scoring of the tests was discussed with the teachers involved in the field trial.

1. Scoring of Mathematics 'Fractions' Test

- Fourth grade: this test consisted of five questions. Maximum score possible for the test is 100, equally subdivided between the five questions and each of these questions was again subdivided. The score for the subdivisions varied, as shown below:

Question No.	Maximum score	Score			
1	20	2	9	9	
2	20	2	8	2	8
3	20	2	2	2	14
4	20	4	16		
5	20	10	10		

- Fifth grade: as for the fourth grade test, the maximum possible score for the test is 100, equally subdivided between the five questions. Scoring for the subdivisions varied, as listed below:

Question No.	Maximum score	Score			
1	20	2	9	9	
2	20	1	2	2	15
3	20	10	10		
4	20	10	10		
5	20	10	10		

- Sixth grade: the test consisted of six questions for which the maximum possible score is 100. This score was subdivided between the six questions as shown below:

Question No.	Maximum score	Score			
1	20	2	9	9	
2	20	2	2	2	14
3	10	10			
4	10	10			
5	20	10	10		
6	20	10	10		

2. <u>Scoring of Science 'Plants and Magnetism' Tests</u>

- Forth and fifth grades ('Plants' test): this test was the same, consisting of ten questions, with a maximum possible score of 100, equally subdivided between the ten questions. The scores of the subdivisions, however, were different, as shown below:

Question No.	Maximum score	Scores				
1	10	5	5			
2	10	2.5	2.5	2.5	2.5	
3	10	2.5	2.5	2.5	2.5	
4	10	2	2	2	2	2
5	10	5	5			
6	10	5	5			
7	10	10				
8	10	10				
9	10	10				
10	10	10				

- Sixth grade ('Magnetism' test): this test consisted of ten questions, with a maximum possible score of 100, equally divided between the ten questions. The scores of the subdivisions, however, differed, as shown below:

Question No.	Maximum score	Scores				
1	10	2.5	2.5	2.5	2.5	
2	10	10				
3	10	2	2	2	2	2
4	10	10				
5	10	10				
6	10	5	5			
7	10	5	5			
8	10	10				
9	10	10				
10	10	10				

APPENDIX 11

Core questions of interview

1 - Core questions for teachers' interviews

1. What is your reaction towards the unit?

2. What is your opinion about this method of teaching hearing impaired children?

3. How did the pupils generally react to the unit?

4. What are the management problems you have had to solve and how did you use the management guide?

5. What is your opinion about this method concerning the talking and the writing of the pupils?

2 - Core questions for pupils' interviews

1. What is your reaction towards the unit?

2. How does the unit compare with your previous science or mathematics studies?

3. How did you find the network of the worksheets? Can you easily progress from one activity to another?

4. Did you have any difficulty with words used?

5. Is it difficult to understand these worksheets?

6. What new words have you learnt? What do they mean?
   Where do you think you will use these words?

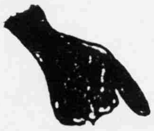
7. Did you enjoy working with your partner?
   Did you talk to one another?

8. Would you like to learn other subjects this way?

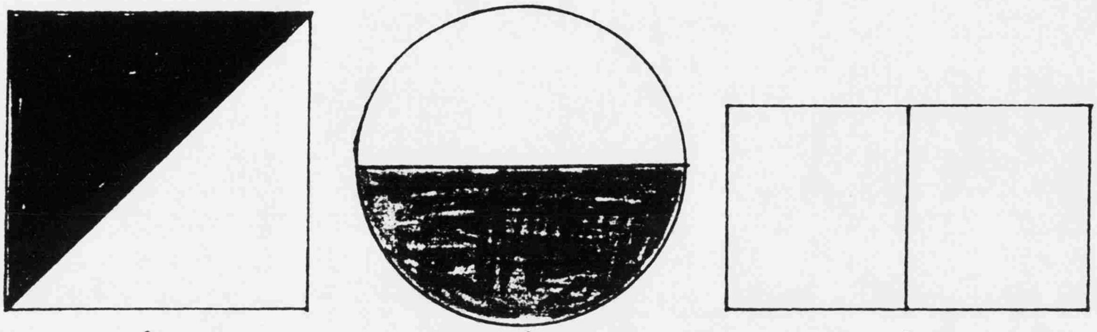
APPENDIX 12

The learning materials for the three unit

Fractions Unit

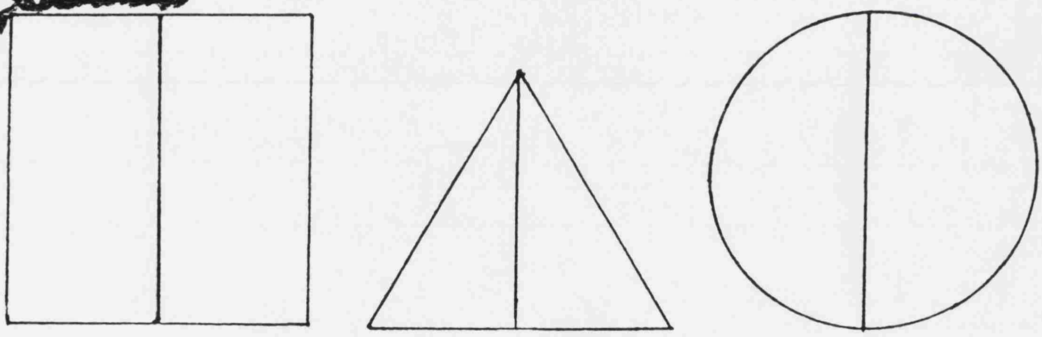
FRACTIONS 

$\frac{1}{2}$



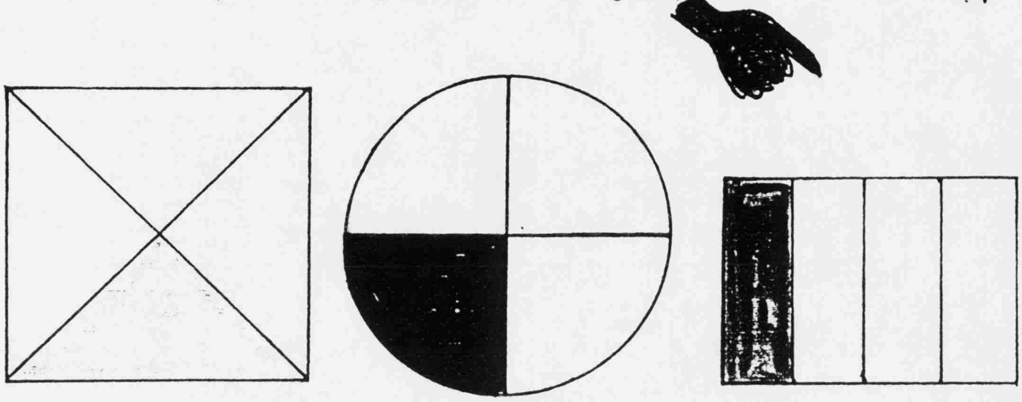
$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

Draw these shapes in your notebook and then colour half of the group and write under every shape $\frac{1}{2}$

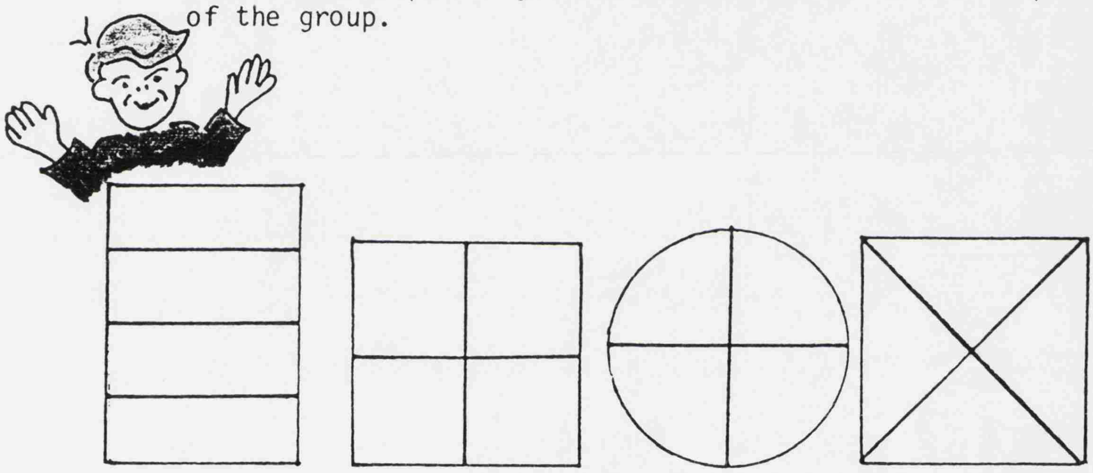


You can see that when you divide anything into two equal pieces, each piece is called a half ($\frac{1}{2}$).

The coloured part is a quarter of the group. $\frac{1}{4}$

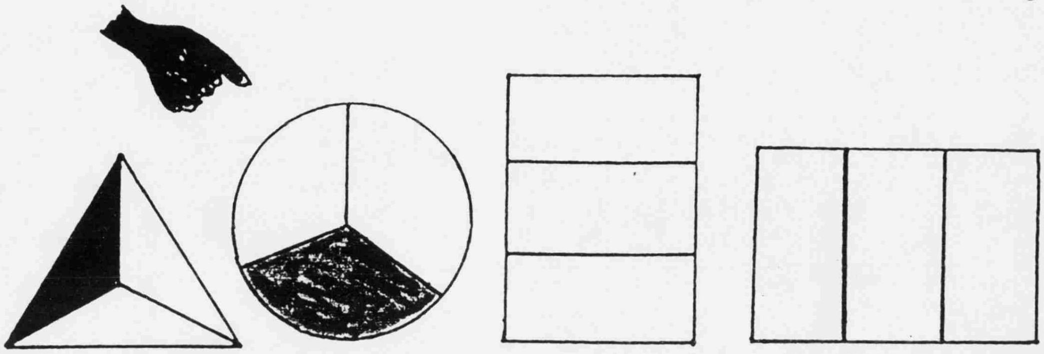


Draw these shapes in your notebook and then colour a quarter of the group.

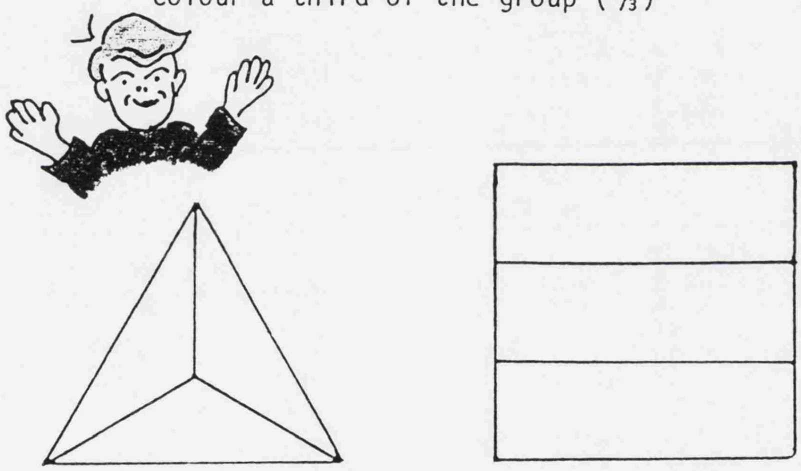


The coloured part of every shape is a quarter ($\frac{1}{4}$) of the whole shape.

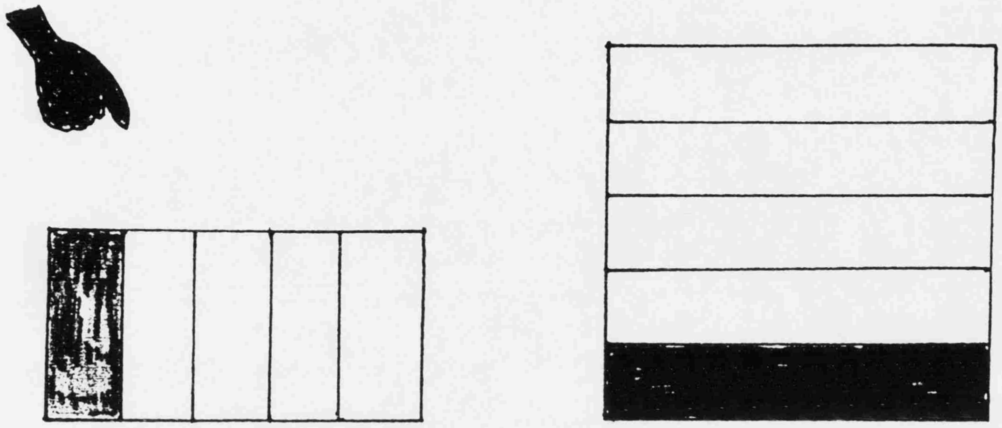
The coloured part a third of the unit. $\frac{1}{3}$



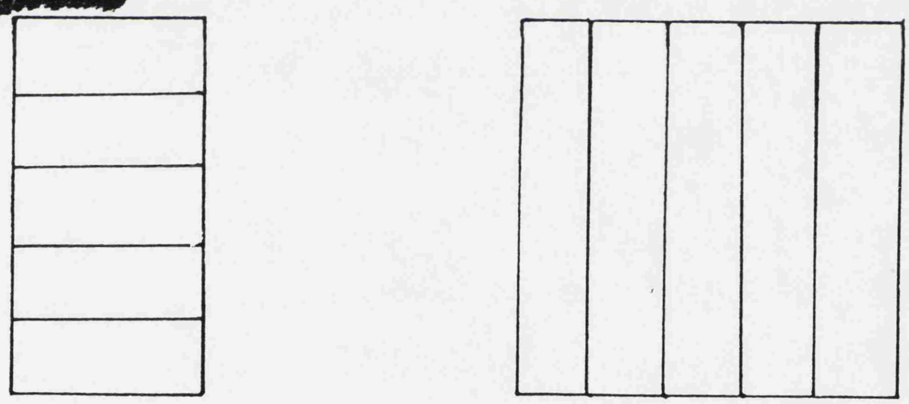
Draw these shapes in your notebook and then colour a third of the group ($\frac{1}{3}$)



The coloured part is one fifth of the group. $^1/_5$



Draw these shapes in your notebooks and then colour one fifth ($^1/_5$) of the group.



A Fractions Chart (work with your friend)

You will need:

- paper and glue (about this size)
- scissors

Cut out four strips of paper.

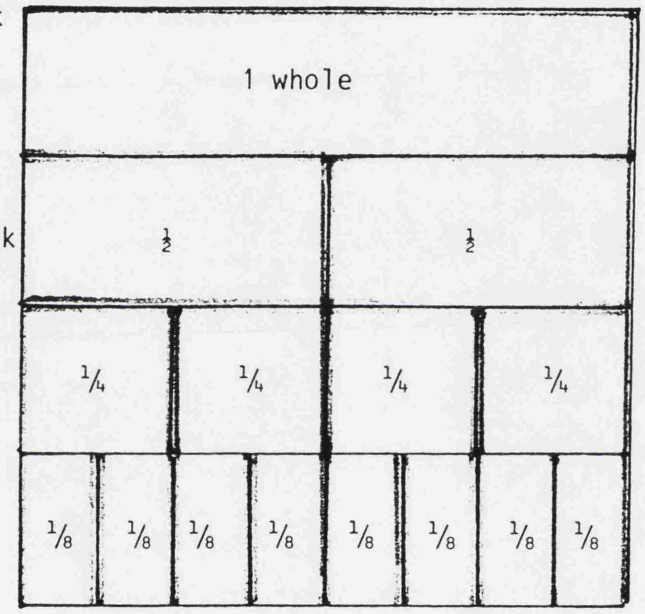
Now follow these steps - use a clean page of your notebook

1st strip....stick in your notebook and label

2nd strip...fold into 2 equal parts, open out, stick in your notebook and label

3rd strip...make 4 equal parts, stick in your notebook and label.

4th strip...make 8 equal parts, stick in your notebook and label.

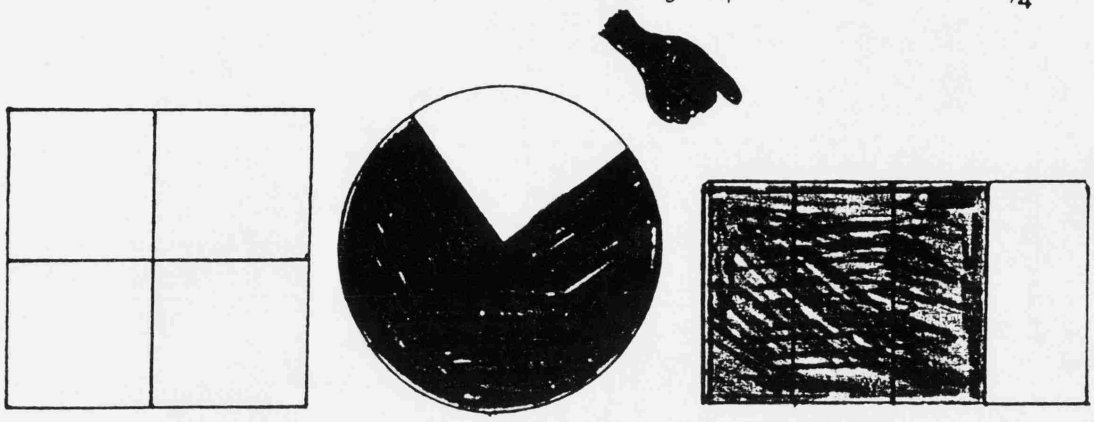


1. Use your fraction chart for these and copy and complete:
   a. $1 = \frac{2}{2}$

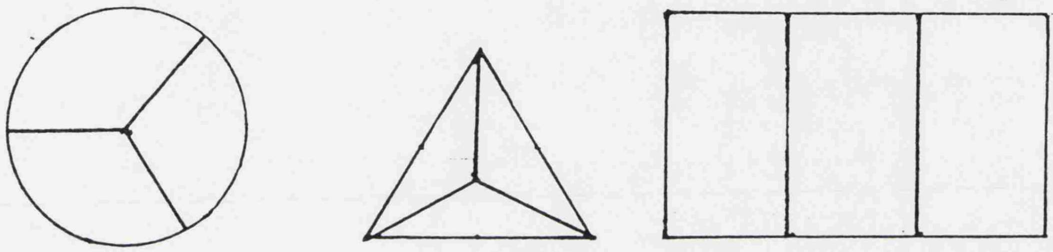
   b. $1 = \frac{\square}{4}$

   c. $1 = \frac{\square}{8}$
2. Make another fraction chart showing these: one whole, one third, one sixth.

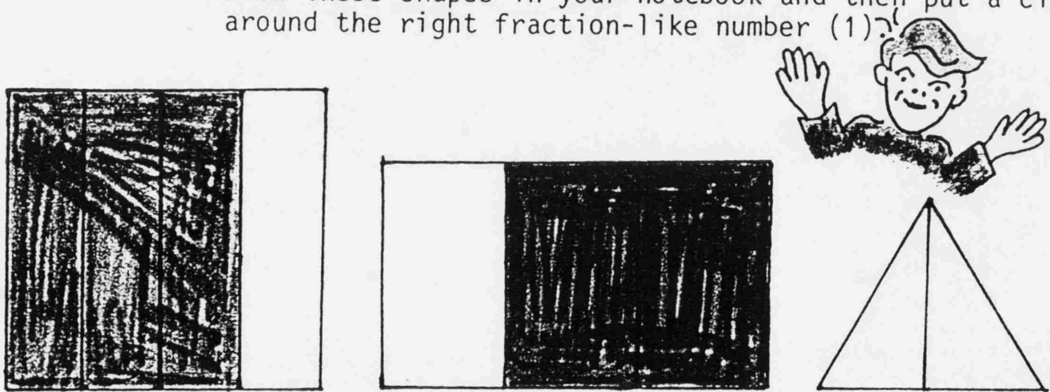
The coloured part is three quaters of the group. $3/4$



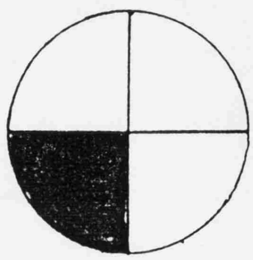
The coloured part is two thirds of the group. $2/3$



Draw these shapes in your notebook and then put a circle around the right fraction-like number (1)

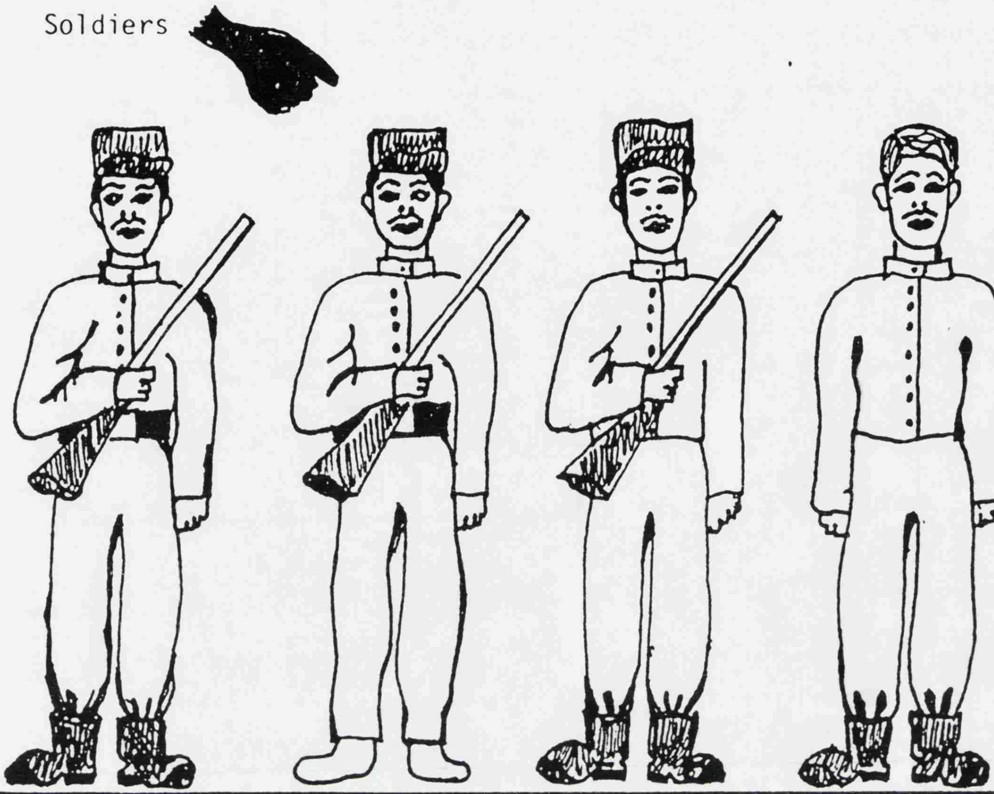


$\frac{1}{2}$ $2/3$ $3/4$ $\frac{1}{2}$ $2/3$ $3/4$ $2/3$ $1/4$ $\frac{1}{2}$



$2/3$, $1/4$

Soldiers



Look at the picture.

Copy these questions into your notebook and then answer them with your friend.

How many soldiers are there altogether? 4

a. How many have guns? 3

What fraction have guns? $^3/_4$

b. How many have boots?

What fraction have boots?

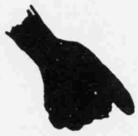
c. How many have hats?

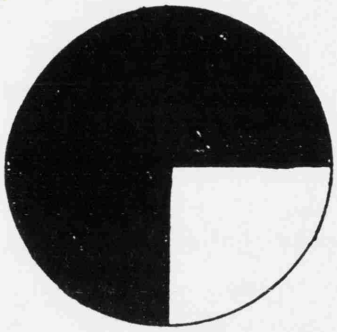
What fraction have hats?

d. How many have belts?

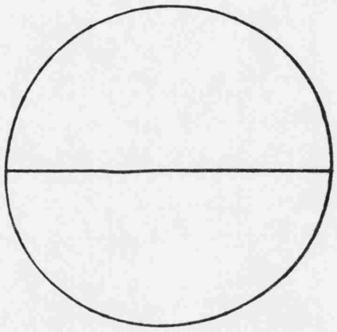
What fraction have belts?

Fractions



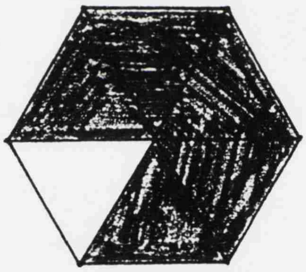


$\frac{3}{4}$ of the group is coloured.

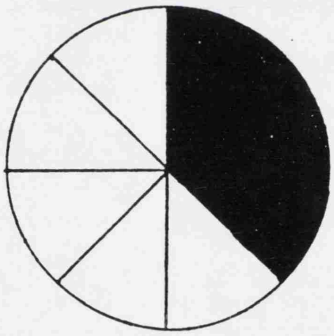


$\frac{1}{2}$ the group is coloured.

Remember that each part must be equal to the other.

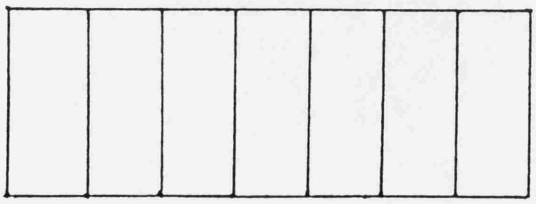


Number of the coloured parts is 5
Number of all parts is 6
i.e., $\frac{5}{6}$ the coloured group.

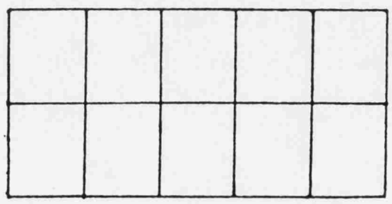


Number of the coloured parts is 3
Number of all the parts is 8
i.e., $\frac{3}{8}$ the coloured group.

Draw and colour these shapes in your notebook and then answer.



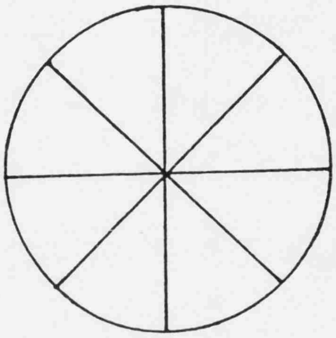
Number of the coloured parts are
Number of all the parts are
Fraction   is the coloured group



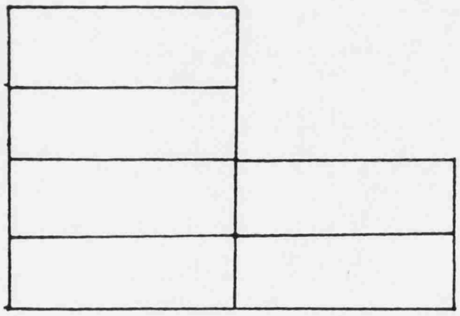
Number of the coloured parts are
Number of all the parts are
Fraction   is the coloured group

Draw these shapes in your notebook and then answer:

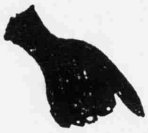
a. colour $^6/_8$ of the parts of the circle.

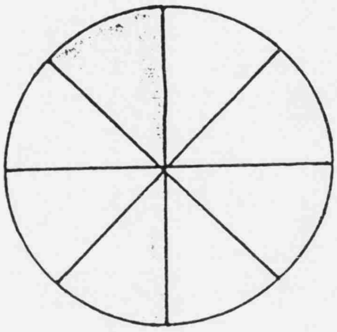


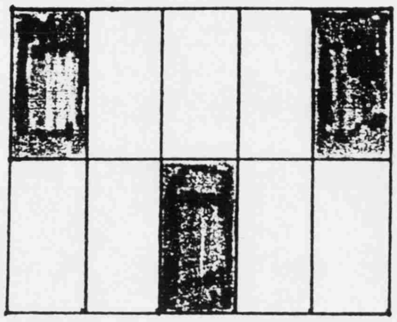
b. colour $^5/_6$ of the parts of this shape.



Fractions divided into coloured and uncoloured parts.







The coloured parts = $^2/_8$

The white parts = $^6/_8$

Blue = $^1/_{10}$

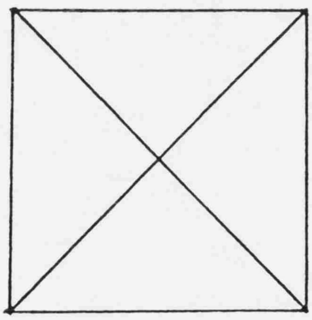
Pink = $^2/_{10}$

White = $^7/_{10}$

Copy these questions in your notebook then answer:

a. Draw and colour the shapes below, then answer:

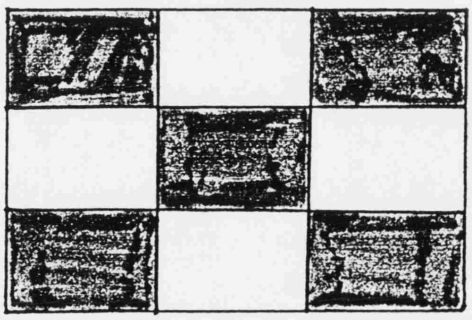
1.



The coloured parts =

The white parts =

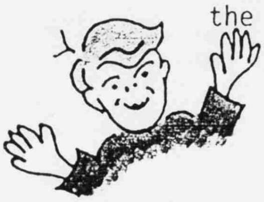
2.

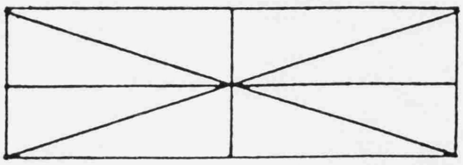


The coloured parts =

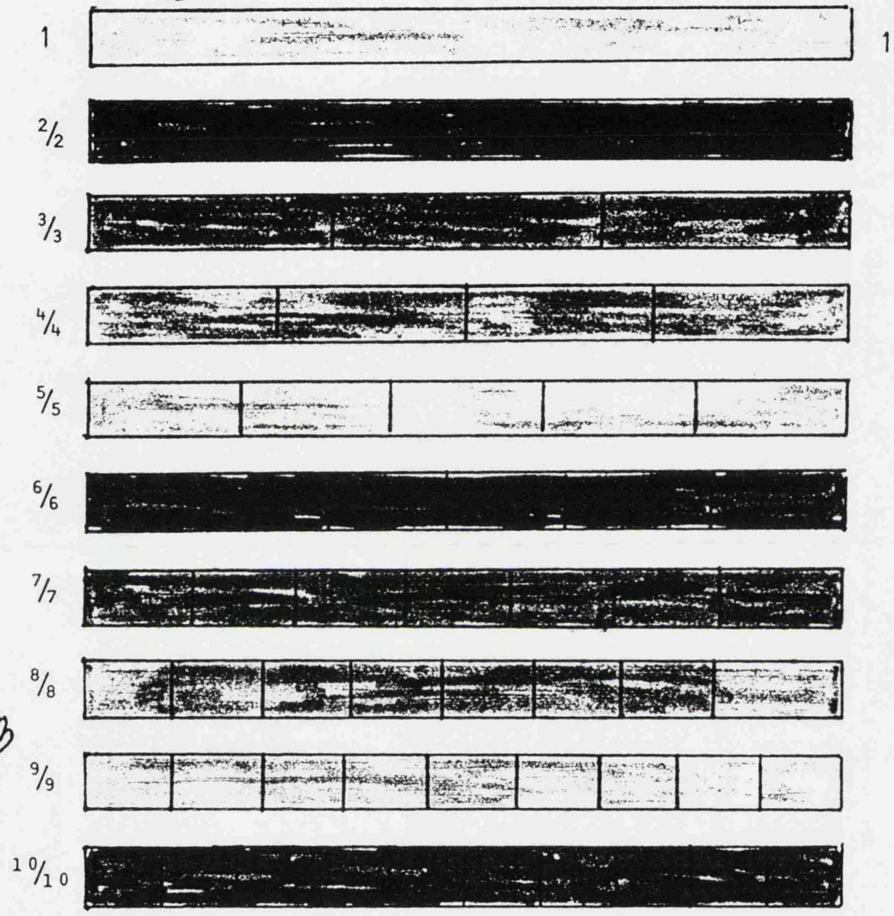
The white parts =

b. Draw and colour $^1/_8$ the group of the shape below. Then write the fraction formed by the uncoloured part.





The name of one 



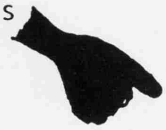
Each fraction is equal to one, *i.e.*, you can divide one into many fractions. Remember each part in the fraction is equal with the others.

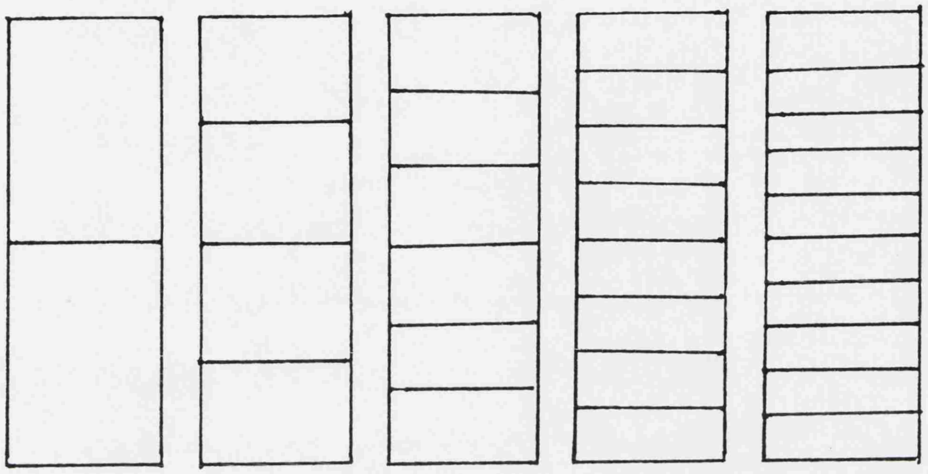
Copy these questions in your notebook, then complete the answer:

a. $\frac{4}{4}$, $1 = \frac{7}{\quad}$. $1 = \frac{\quad}{10}$, $1 = \frac{4}{\quad}$

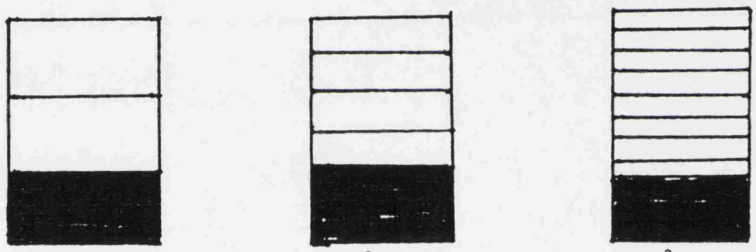
b. $\frac{9}{9} = \frac{2}{2}$, $\frac{5}{\quad} = 1$, $\frac{3}{3} = \frac{4}{\quad}$, $\frac{8}{8} = \frac{\quad}{6}$

A fraction has many names



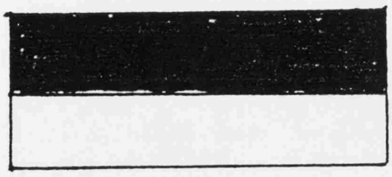


$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$

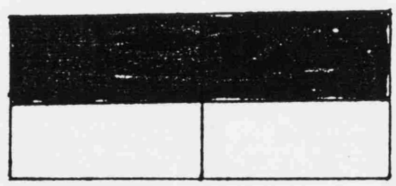


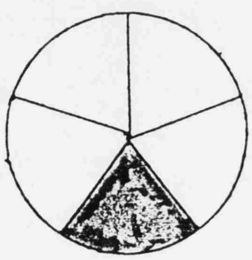
$\frac{1}{3}$ $\frac{2}{6}$ $\frac{3}{9}$

Draw and colour these shapes then answer the questions:

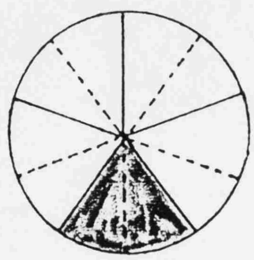


$\frac{1}{2} = \frac{\quad}{4}$

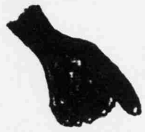


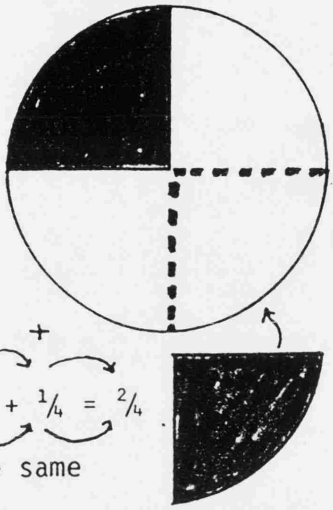


$\frac{1}{5} = \frac{2}{\quad}$



The addition of fractions

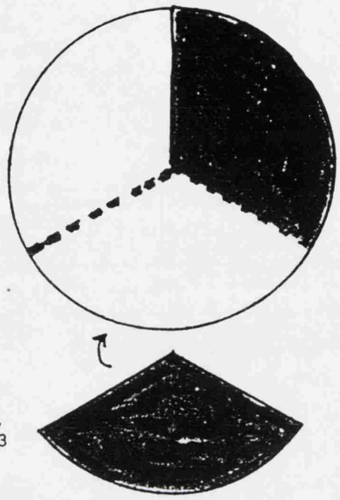




$^{1}/_{4} + {}^{1}/_{4} = {}^{2}/_{4}$

the same

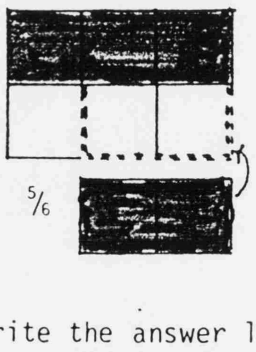
$^{1}/_{3} + {}^{1}/_{3} = {}^{2}/_{3}$



i.e., if you add this $^{1}/_{4}$ to the $^{1}/_{4}$ in the circle, this will equal $^{2}/_{4}$

Method of adding: Put the same bottom number because these are the same. - add the number above.

Here are other examples:



$^{3}/_{6} + {}^{2}/_{6} = {}^{5}/_{6}$

You can write the answer like the ones shown below:

$^{3}/_{6} + {}^{2}/_{6} = {}^{3+2}/_{6} = {}^{5}/_{6}$

$^{1}/_{6} + {}^{1}/_{6} = {}^{1+1}/_{6} = {}^{2}/_{6}$

Copy these questions in your notebook and complete the answers:

a. $^2/_9 + {}^5/_9 =$ $\qquad$ $\dfrac{2 + \boxed{}}{9} = \dfrac{\bigcirc}{9}$

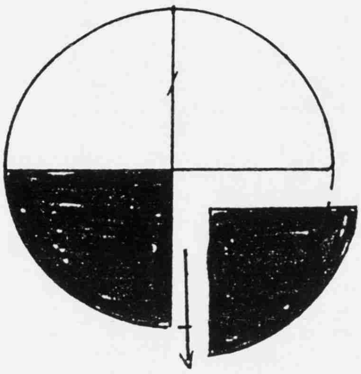
b. $^3/_8 + {}^2/_8 =$ $\qquad$ $\dfrac{\boxed{} + \boxed{}}{8} = \dfrac{\bigcirc}{8}$

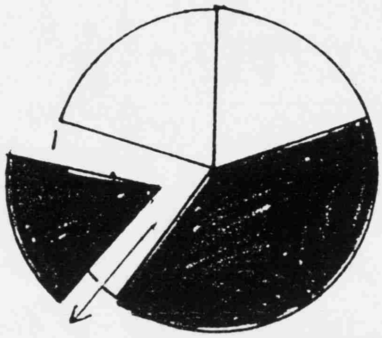
c. $^1/_7 + {}^3/_7 =$

d. $^1/_5 + {}^3/_5 =$

e. $^4/_{10} + {}^1/_{10} =$

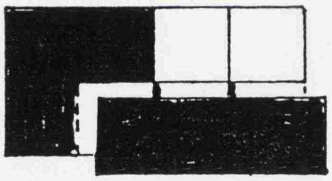
The subtraction of fractions





$^2/_4$ - $^1/_4$ = $^1/_4$ $\qquad$ $^3/_5$ - $^1/_5$ = $^2/_5$

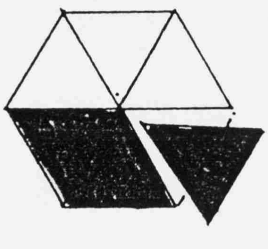
i.e., all the parts are $^4/_4$
Brown parts equal $^2/_4$ of the whole. If you take away from it $^1/_4$
$^1/_4$ remains.



$^6/_8$ - $^3/_8$ = $^3/_8$

> Method of subtraction:
> Put the same bottom number because
> they are the same (equivalent)
> - subtract the above number

Here is another example



REMEMBER

$^3/_6$ - $^1/_6$ = $^2/_6$

or $^3/_6$ - $^1/_6$ = $^{3-1}/_6$ = $^2/_6$

Copy these questions in your notebook and complete the blanks with your partner.

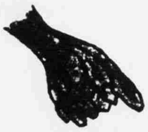
a. $\frac{6}{7} - \frac{2}{7} = \frac{6-2}{7} = \frac{\square}{7}$

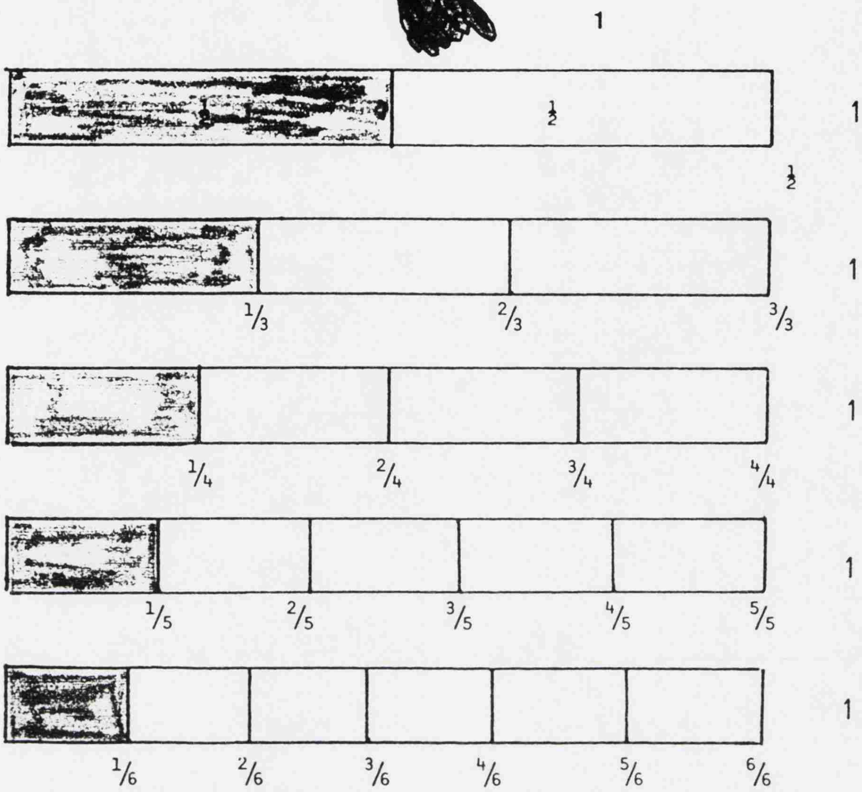
b. $\frac{3}{5} - \frac{1}{5} = \frac{3-1}{5} = \frac{\square}{5}$

c. $\frac{5}{9} - \frac{2}{9} = \frac{5 - \square}{9} = \frac{\triangle}{9}$

d. $\frac{9}{10} - \frac{7}{10} = \frac{9-7}{10} = \frac{\square}{10}$

Some names of number one





You can name the number 1 or $^{2}/_{2}$, 1 or $^{5}/_{5}$ ......*etc.*
REMEMBER each part is equal with the others.

Copy these questions in your notebook and then complete:

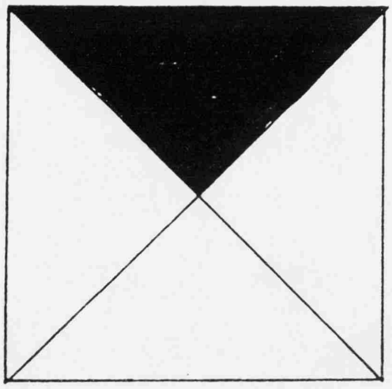
$1 = \dfrac{\boxed{}}{15}$ $\qquad$ $1 = \dfrac{62}{\boxed{}}$

$1 = \dfrac{7}{\boxed{}}$ $\qquad$ $1 = \dfrac{11}{\boxed{}}$

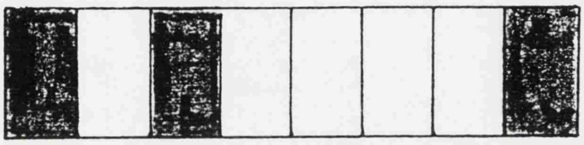
$1 = \dfrac{\boxed{}}{40}$ $\qquad$ $1 = \dfrac{10}{\boxed{}}$

$1 = \dfrac{\boxed{}}{85}$ $\qquad$ $1 = \dfrac{15}{\boxed{}}$

Fractions

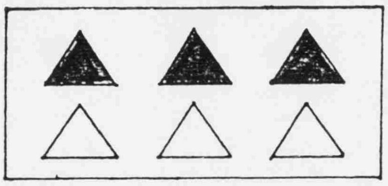


If $\frac{1}{4}$ is coloured, then a fraction of the coloured part is a fraction of $\frac{1}{4}$.



A fraction of the coloured part is $\frac{3}{8}$. A fraction of the part without colour is $\frac{5}{8}$.

i.e., all the groups are 8 parts, 3 of them are with colour and 5 of them are without colour. So you can write it like this if you have sets.

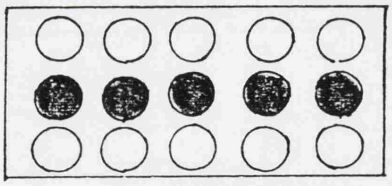


$\frac{1}{2}$ shapes are red

6 all the shapes

3 shapes are red

$\frac{1}{2}$ the 6 = 3

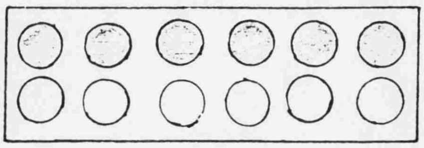


$\frac{1}{3}$ shapes are red

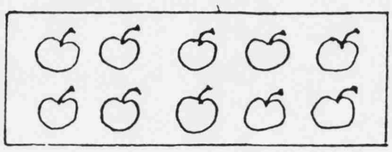
15 shapes are red

$\frac{1}{3}$ the 15 = 5

Copy and complete. Work with your friend

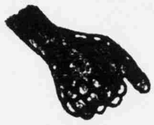


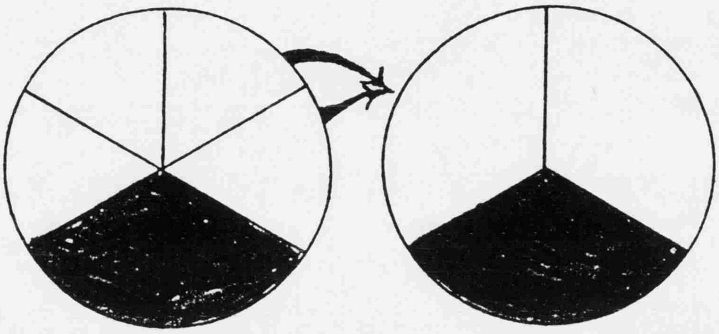
$\frac{1}{2}$ the 12.........



$\frac{1}{2}$ the 10..............

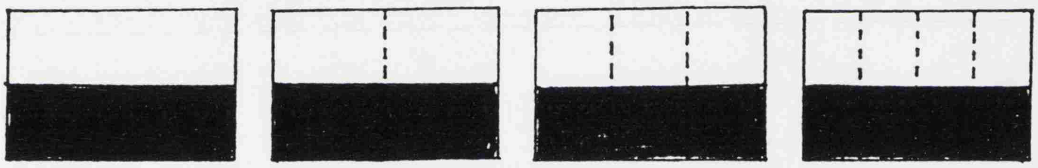
Equivalent fractions





$^2/_6$ = $^1/_3$

$^2/_6$ and $^1/_3$ are equivalent fractions. They mean the same.



$\frac{1}{2}$ = $^2/_4$ = $^3/_6$ = $^4/_8$

They are equivalent fractions.

There is a quick way of finding fractions equivalent to $\frac{1}{2}$:

$\frac{1}{2}\ \frac{\times 2}{\times 2}\ ^2/_4 \qquad \frac{1}{2}\ \frac{\times 3}{\times 3}\ ^3/_6 \qquad \frac{1}{2}\ \frac{\times 4}{\times 4}\ ^4/_8$ we could go on forever

When we multiply both the NUMERATOR (above number), and the DENOMINATOR (bottom number) of a fraction, we get an EQUIVALENT FRACTION.

Copy these questions in your notebook and then answer them with your partner:

1. Use the quick method to find six fractions equivalent to each of these:

   a. $^1/_4$ b. $^2/_3$

   c. $^3/_5$ d. $^1/_{100}$

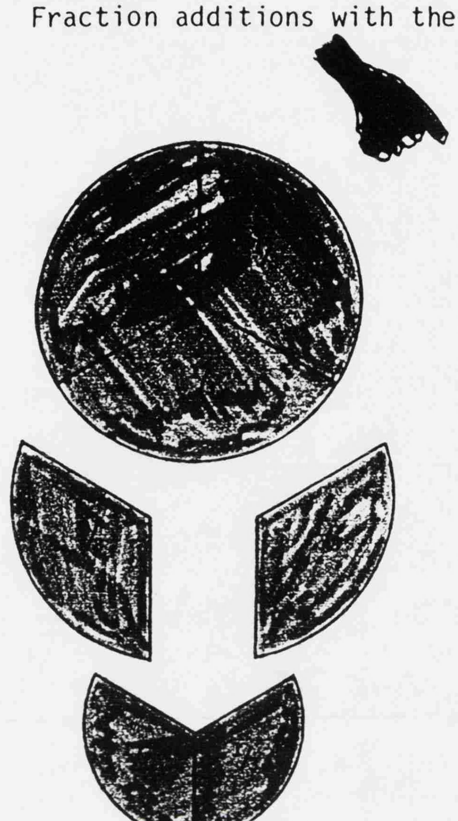
2. Fill in the gaps:

   a. $\frac{1}{2} \xrightarrow[\times 5]{\times 5} \frac{\;}{10}$ b. $\frac{2}{5} \xrightarrow[\times 4]{\times 4} \frac{\;}{20}$

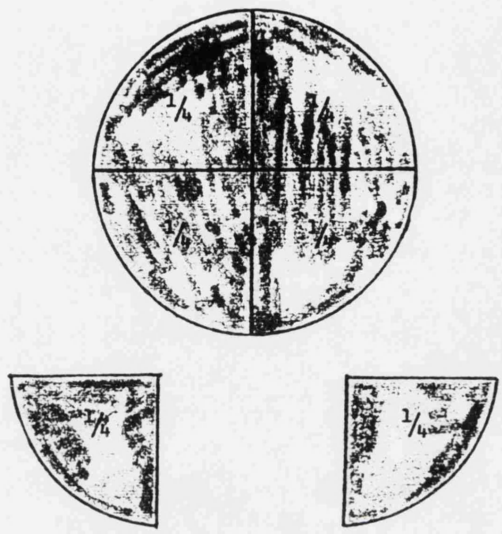
   c. $\frac{3}{4} = \frac{\boxed{}}{16}$

   d. $\frac{5}{8} = \frac{\boxed{}}{40}$

Fraction additions with the equal denominator



$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$



$\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$

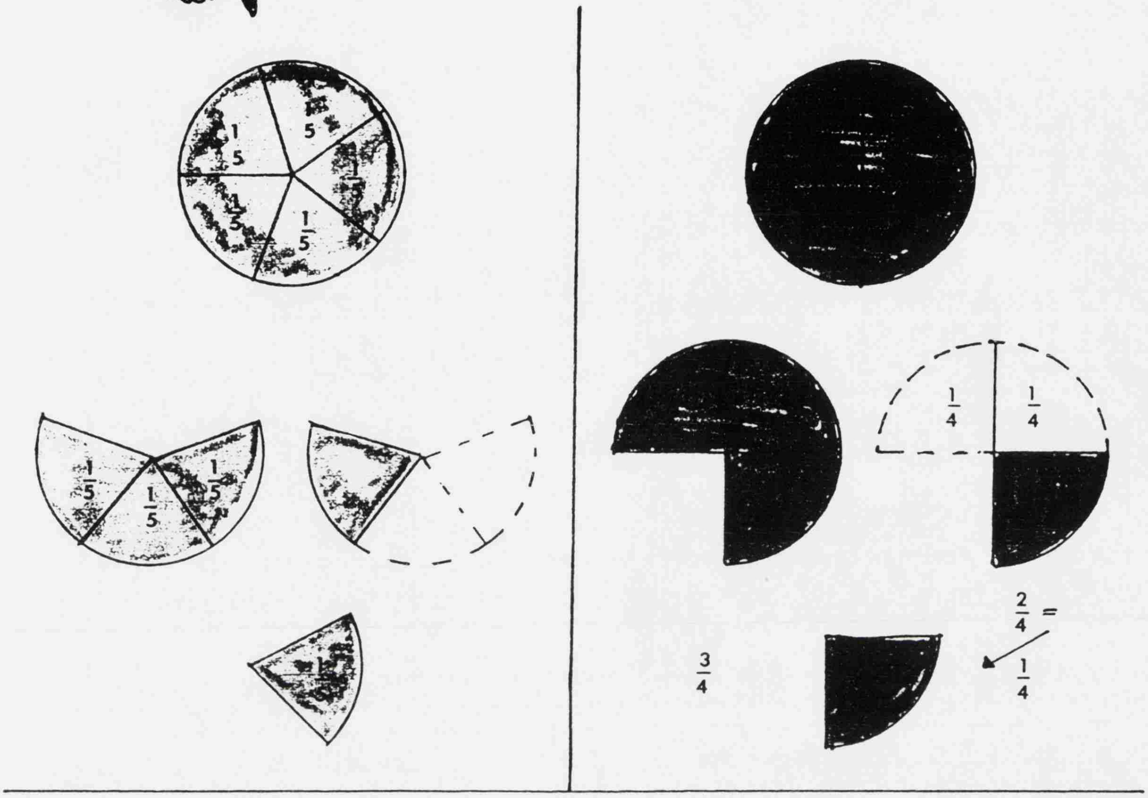
REMEMBER

> When you add fractions with equal denominator, you add the numerators only. The denominators remain unchanged.

Copy these questions in your notebook and then asnwer.
Work with your partner.

1. A lorry was loaded with $\frac{1}{5}$ ton of soil, $\frac{2}{5}$ ton of soil was added to it. How much was in the lorry?
2. A labourer finished $\frac{6}{10}$ of his work in the morning and finished $\frac{4}{10}$ of his work in the afternoon. How much did he finish?

Fractions subtract with Equal Denoimators



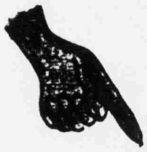
REMEMBER

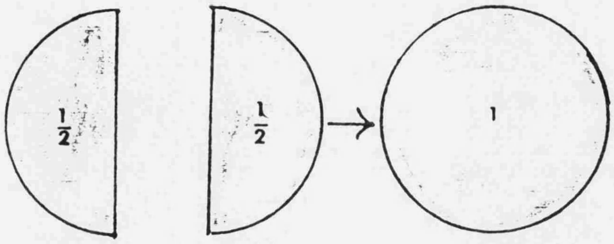
> When you subtract fractions with equal denominators, you subtract the numerators only. The denominators remain unchaged.

Copy these questions in your notebook and then answer them. Work with your partner:

1. A lorry with loaded goods, weights $^3/_4$ ton. Take away $^1/_4$ ton. How much remains?
2. A lorry was loaded with $^7/_8$ ton of sugar. $^5/_8$ ton was taken from it. How much remains?

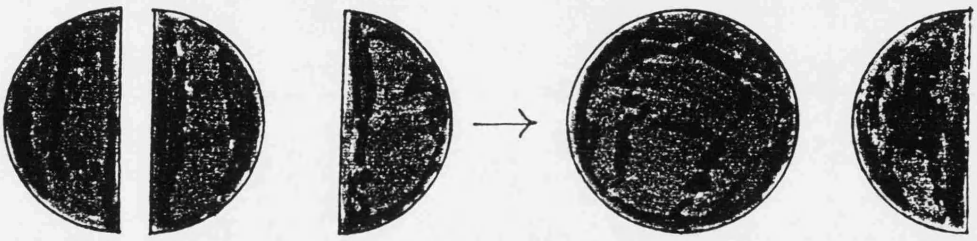
Mixed numbers





2 haves = 1

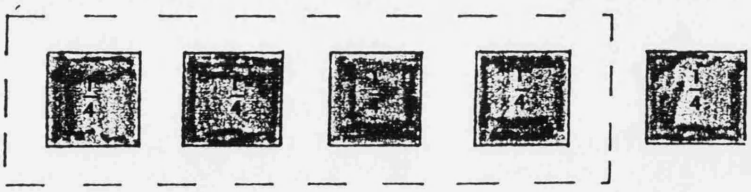
$^2/_2$ = 1 Remember?



3 halves = 1 $^1/_2$

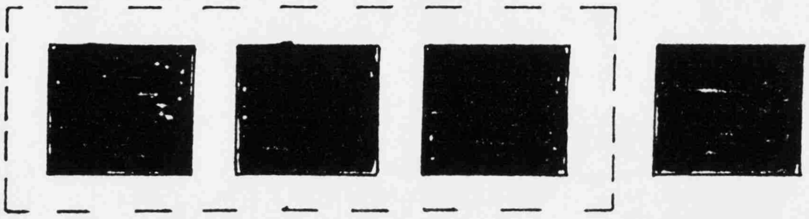
You can write it $^3/_2$ = $1\,^1/_2$

You can also solve such problems like this:



Total = 5 fourths
4 fourths = 1
$1\,^1/_4$ is a mixed number

Turn over



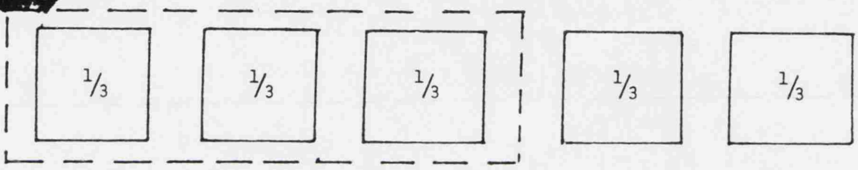
Total = 4 thirds

3 thirds = 1

$1\frac{1}{3}$ is a mixed number

Copy these questions in your notebook. Then fill in the gaps.

A

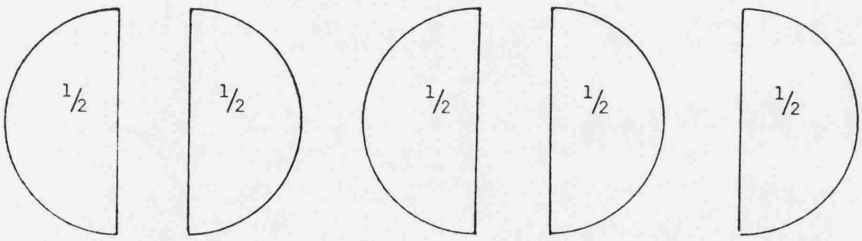


☐ thirds = total

3 thirds = 1

$1\frac{1}{3}$ is a mixed number

B



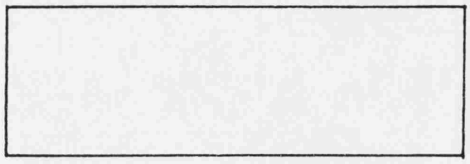
☐ halves = total

☐ halves = 1

☐ mixed number

A Fraction Chart

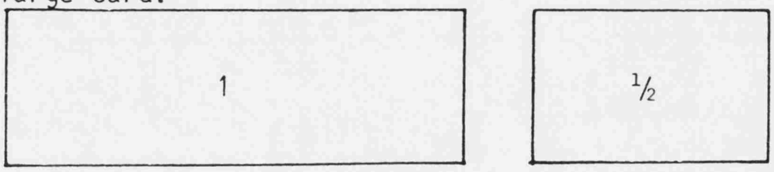
You will need:-



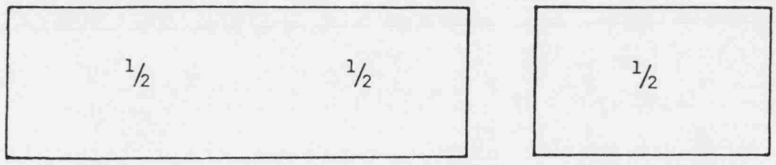
paper and glue
scissors
large card

Work with your friend. Cut out 9 strips of the paper. Now follow these three steps - use the large card.

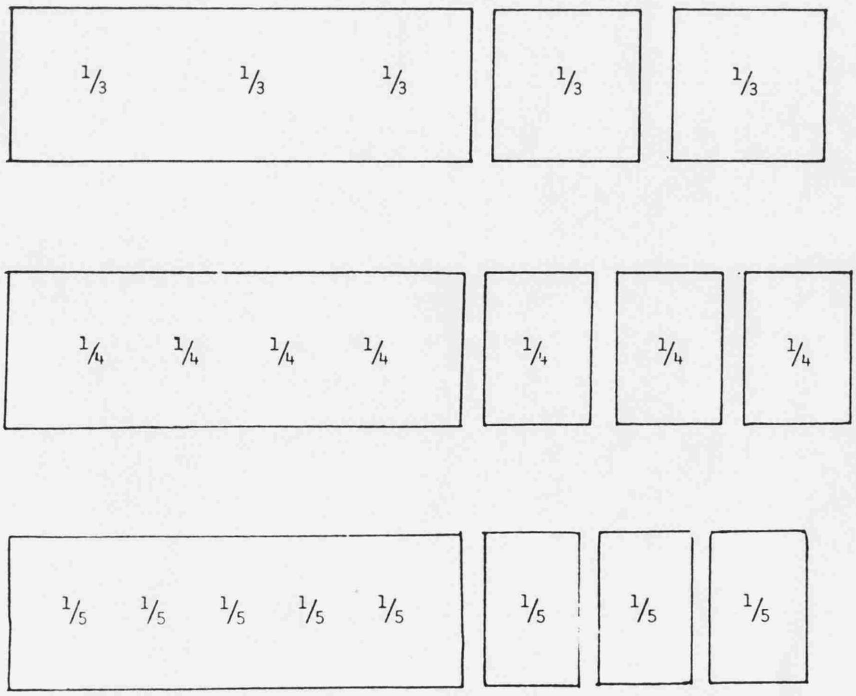
1. 1st strip...stick on the card and label



2. 2nd strip...fold into 2 equal parts, open out, stick on the card and label

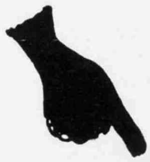


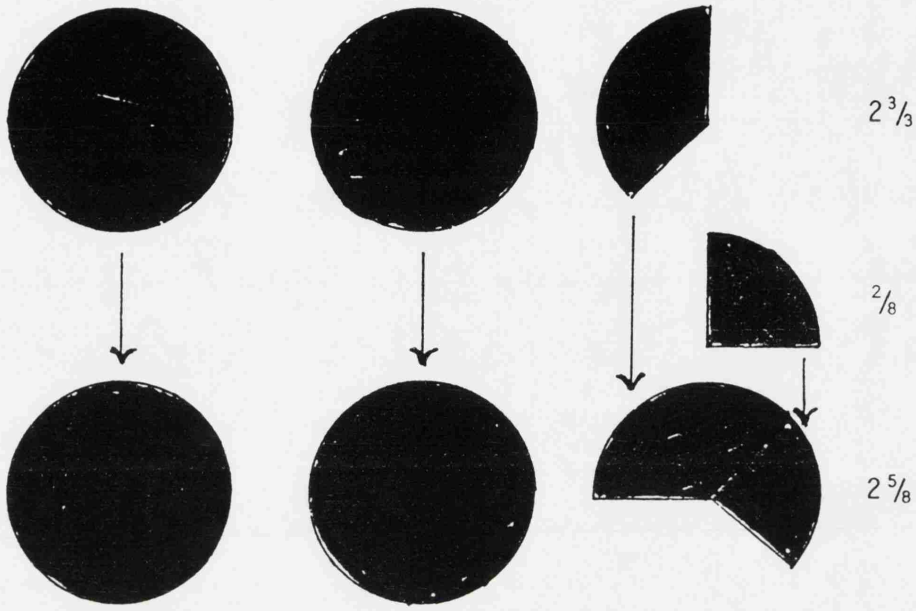
3. 3rd strip...fold into 3 equal parts, open out, stick on the card and label



When you finish, write the mixed number under each one.

The adding of mixed numbers





i.e., $2\,{}^{3}/_{8} + {}^{2}/_{8} = 2\,{}^{5}/_{8}$ Remember...the equal bottom number

or $2\,{}^{3}/_{8} + {}^{2}/_{8} = 2\frac{3+2}{8} = 2\,{}^{5}/_{8}$

Copy these questions in your notebook then answer them.

a. $1\,{}^{1}/_{4} + {}^{2}/_{4} =$

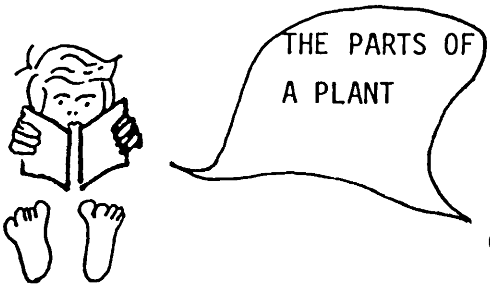
b. $2\,{}^{3}/_{10} + {}^{4}/_{10} =$

c. $2\,{}^{2}/_{6} + {}^{3}/_{6} =$

d. $2\,{}^{2}/_{5} + {}^{1}/_{5} =$

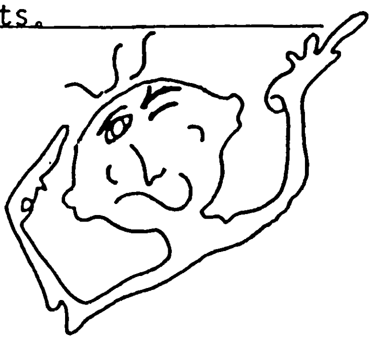
e. $3\,{}^{1}/_{3} + {}^{1}/_{3} =$

Plants Unit

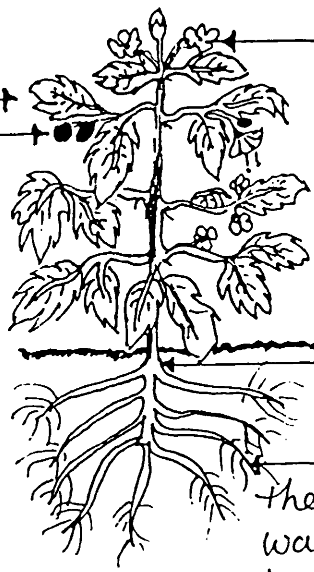


Your body consists of organs and each organ has a function. The body of a plant consists of parts also and each part has a function.

A plant's body consists of root; stem; leaves; flowers and fruits.



Copy this question in your notebook and answer it.
Draw a plant and label the parts of it.

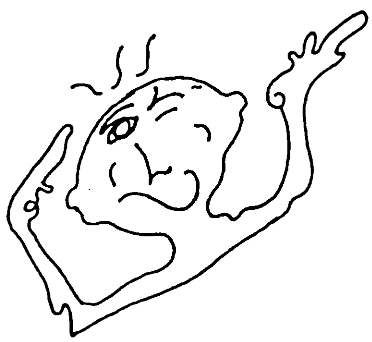


The parts of a plant

ROOTS

Did you try to pull up a plant from the soil? It is difficult, especially when the plant is large, because there are many roots. Roots anchor the plant firmly in the soil and prevent it being blown over by the wind. They draw water and mineral salts from the soil and pass them into the stem.

Frequently, roots can act as food stores.



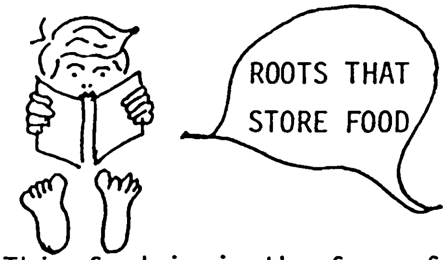
Copy this question in your notebook and answer it with your friend.

What are the functions of the roots?

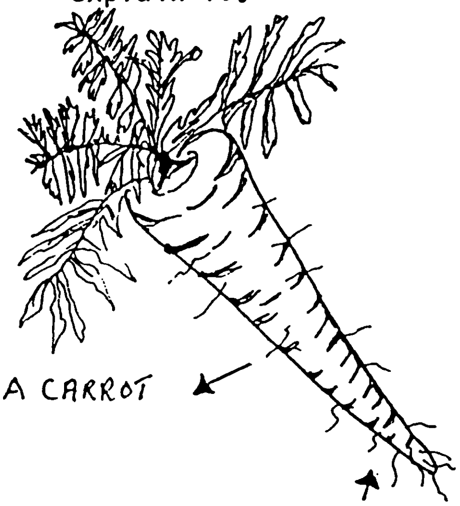
1.

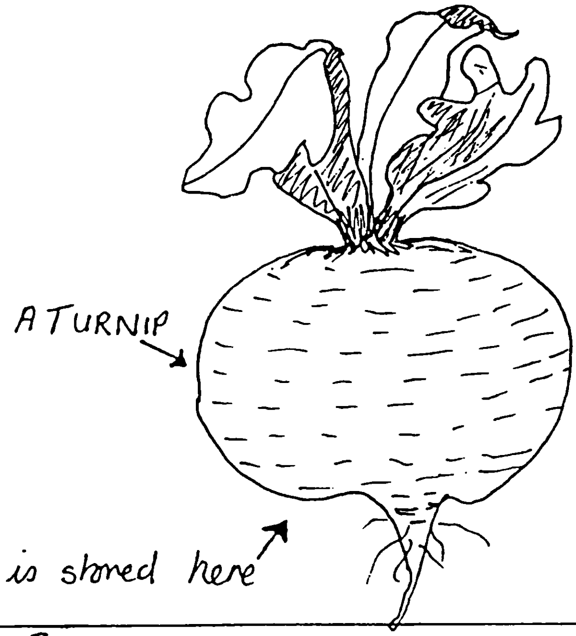
2.

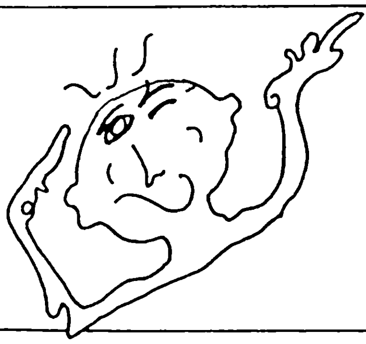
3.



Here are some roots that store food. This food is in the form of starch and we can use it for our own food. If you do not know what starch is, ask your teacher to explain it.

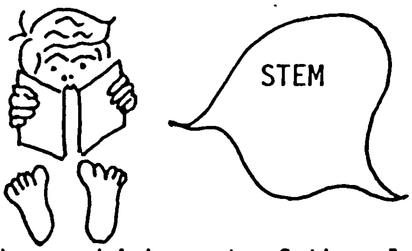






Copy this question in your notebook and answer it.

Collect roots that store food for your nature table. Draw and label them.



The sheet labelled No.1 helps you to know which part of the plant the stem is. If you want to know what the function of stems is, the teacher can prove this by experiment. Take a plant and water it with coloured water (red ink). Cut the stem 5 cm above the soil after some minutes. You will see the coloured water dripping from the cut part; this means that water is going up through the stem. From this experiment you learn that the function of the stem is to bring the raw materials to the rest of the plant.

The other functions of stems are:

a) to hold the plant up;
b) to act as food stores.

Copy these questions in your notebook and then answer them.

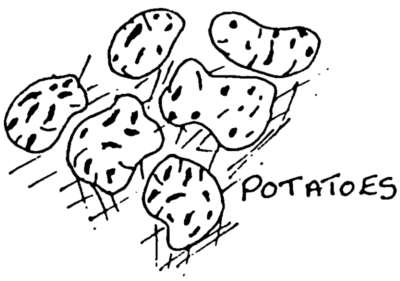
a) What is the main function of the stem?

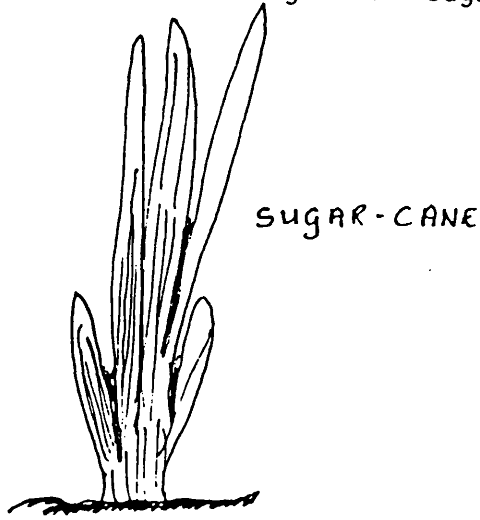
b) What are its other functions?

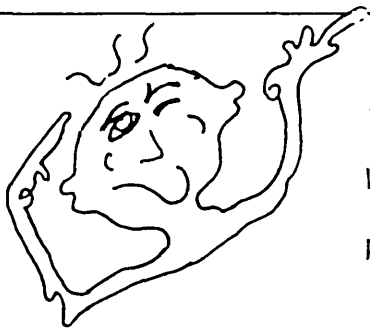
Answer these questions with your friend.

In previous lessons, we mentioned that stems can act as food stores. Potatoes are good examples of stems that store food. They are underground stems. These underground food stores are the stems of the plants and not their roots. Therefore, do not mix them up with roots just because they are underground.

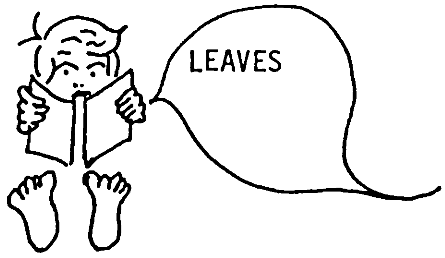
There are also stems that store food above the ground - sugar cane is a good example.







Discuss this question with your partner, then write the answer in your notebook. What food can you get from a sugar cane plant?



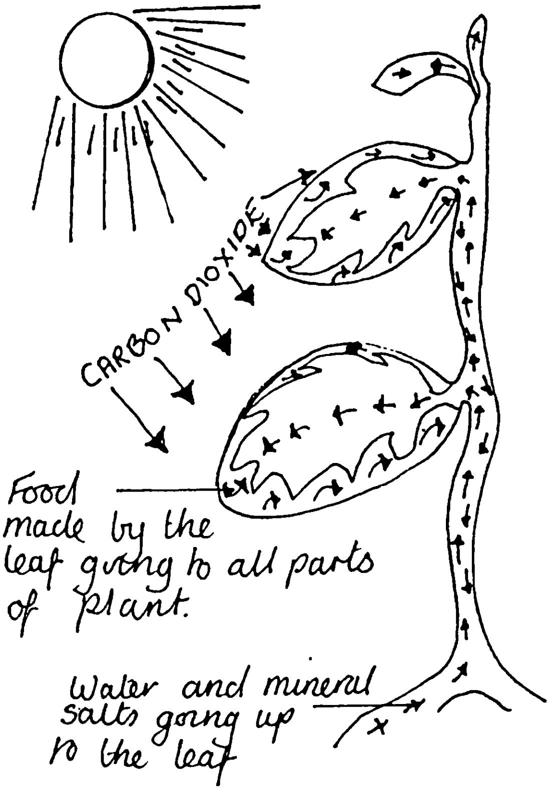
Plants and animals are living things and they are alike in many ways, but there is one big difference between them. This is the way in which they obtain their food.

Animals can catch their food, or at least they can move about and look for it.

Plants cannot catch their food. They have to make their own food.

Have you ever wondered why plants grow so many leaves and why the leaves are mainly green?

The answer is that plants need these green leaves to make food. These leaves are the food factories of plants. A leave has food canals carrying water and mineral salts to all parts of the leaf and it then sends out the food made in the leaf to the rest of the plant.



A plant needs sunlight and carbon dioxide from the air and food materials like water and mineral salts from the ground to make food. The green cells in its leaves change carbon dioxide and water into sugar and give out oxygen. To do this, the green cells need energy and they get this energy from sunlight. Look at the picture on the left.
At night, when there is no sun, the leaves do not make food.

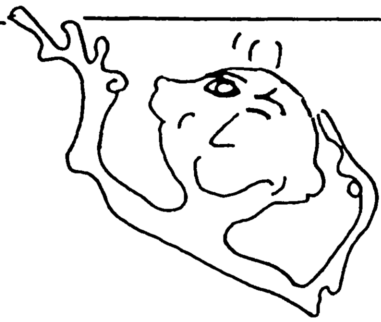
Discuss this question with your teacher and copy the answer in your notebook.

Green leaves make food for the whole plant.

What happens to leaves that are yellow?

Do leaves that are yellow make food?

There are no living leaves which are completely yellow, because yellow leaves cannot make food. When a leaf has yellow parts, such yellow parts cannot make food.



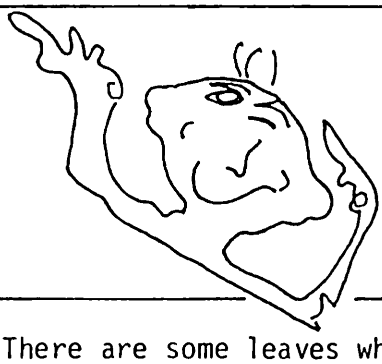
Copy this question in your notebook and then answer it.

What happens to a leaf which is turning yellow?

You have just learnt that leaves make food out of water and carbon dioxide when there is sunlight. The food they make is sugar.

In the sunlight, the leaves make a lot of sugar. The leaves cannot carry all this sugar away to the other parts of the plant, so the leaves change the sugar into starch - remember what the teacher said about the starch? This starch is kept and stored in the leaves. At night, when the sun is not shining, the starch changes back to sugar and then it is carried away as food to the rest of the plant.

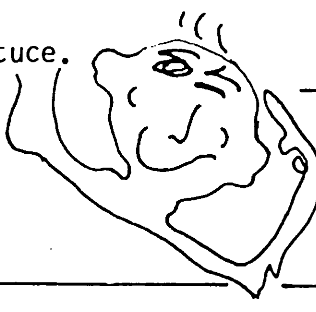
Remember that sugar is the food that the plant can use at once. Starch is the food that the plant keeps and stores. The plant makes sugar for its food. If it makes too much, it can change this sugar into starch and keep it. When the plant needs food again, it changes the starch back into sugar.



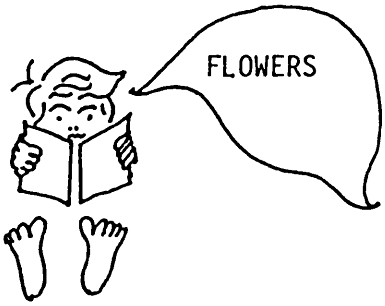
If you understand the previous passage, copy this question in your notebook and then answer it.

What do leaves store?

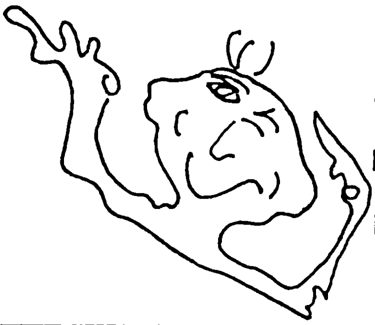
There are some leaves which we can use for food, like cabbage and lettuce.



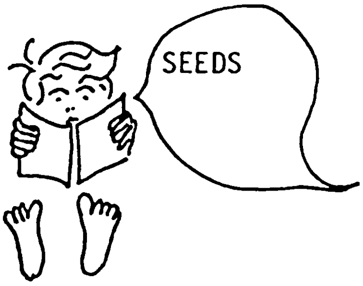
Collect some leaves that can be eaten. Draw and label them.



The important function of the flower is to make the fruit which contains seeds. Seeds become new plants. Therefore, the main function of the flower is the production of seeds. There are also some flowers you can eat, like cauliflowers.

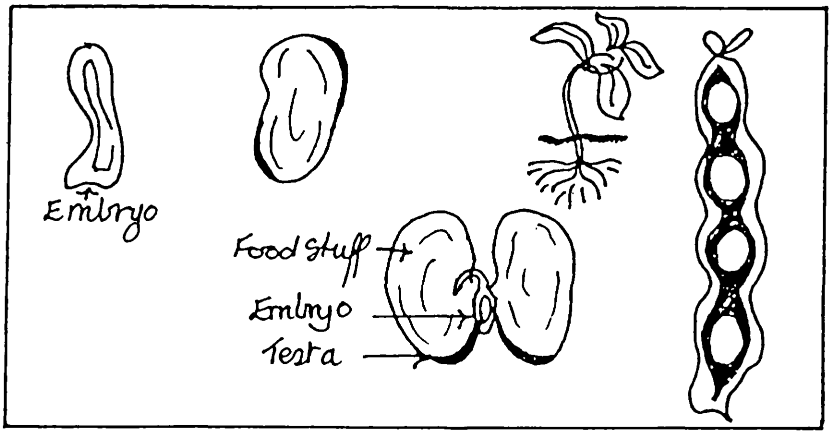


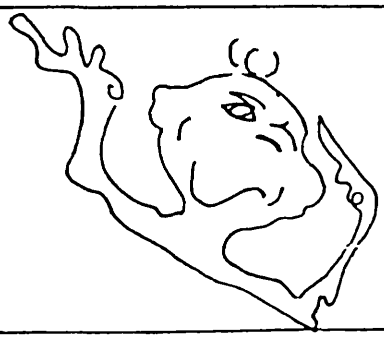
Copy this question in your notebook and answer it with your partner. Make a list of some flowers that become a fruit.



If you want to find out the function of seeds, you can prove it by an experiment, by taking bean seeds or chick pea seeds and putting them in water for two days, then open one of them. What do you find? You find an embryo between the two cut pieces.

Could you plant different sorts of seeds in a flower pot. Water them regularly until the seeds grow to be small plants. The embryo that you see, grows and becomes a small plant. Therefore, the main functions of the seeds are to reproduce the plant and act as a food.





Copy these questions in your notebook and answer them.

a. Draw and label the picture above.

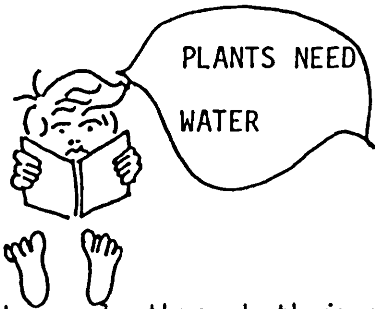
b. What is the main function of the seeds?

However, some plants do not begin their lives from seeds. Date palms increase by palm seedlings, others by cutting a part of the old plant, like grapes.

Peas and beans are good examples of seeds that store food. You can see them in the market.

The food that is stored in the seeds feeds the young plants and helps them to grow quickly. While the plants are very young, they do not have green leaves to make food, so they need the food in the seed in order to grow. This is the main reason why seeds store food.

Collect pictures of some seeds and fix them in your notebook, then label them.



Like all other living things, plants need water to live and grow. They can take in water only through their roots. Their roots, therefore, must grow in such a way that they can find water.

If you want to prove this, you need: (work with your friend)

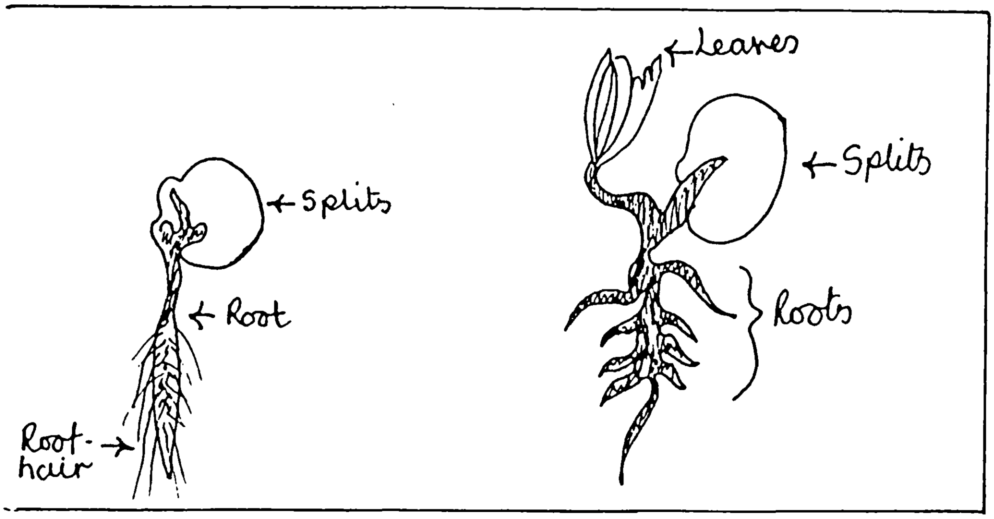
a. some broad bean, chick pea and corn seeds;

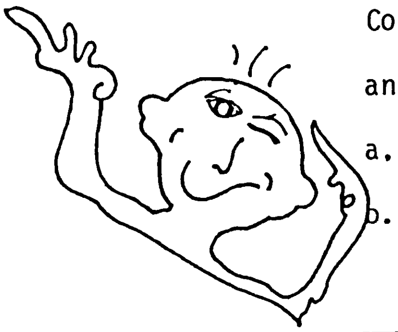
b. a bowl

c. cotton wool

d. water

Now take some of the seeds, leave half of them dry and put the other half in water in the bowl. Then put a layer of cotton wool in the bowl, saturate the cotton wool with water and put the seeds in it. Ask the teacher for help. Add some water from time to time to keep the cotton wool wet. You will see, after a few days, each seed grows with small roots, then the stem appears and grows up as shown in the picture below, while the dry seeds remain ungrown.



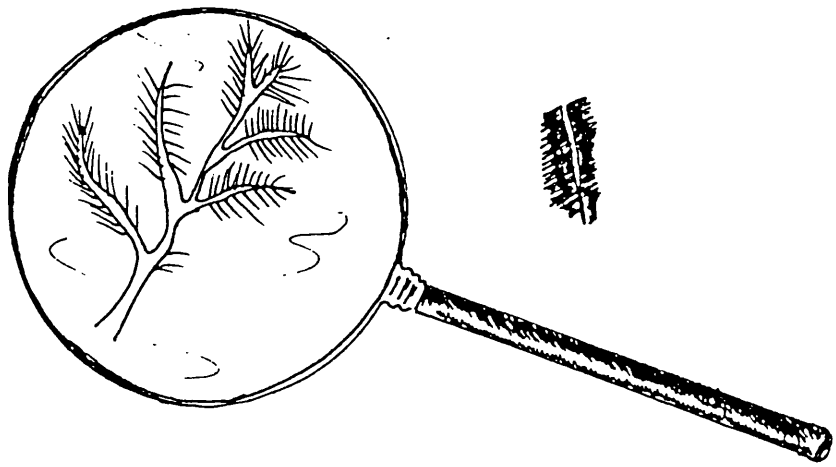


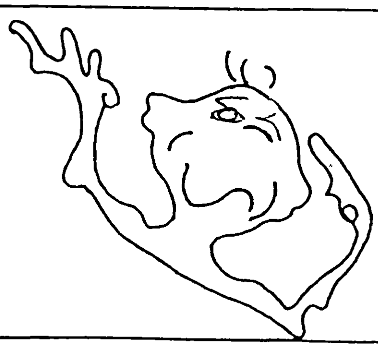
Copy these questions into your notebook and write your answers:

a. Why do dry seeds not grow?

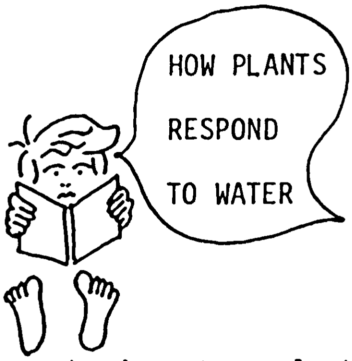
b. Draw the growth of the plant seed and label the parts of it.

When you finish drawing the seed growth of the plant, take a magnifying glass and examine one of the growing seeds. You see that there are root hairs. Their work is to provide the plant with water and mineral salts from the soil.

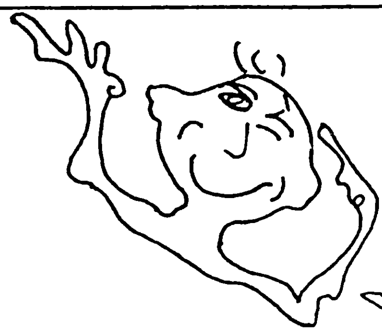




Discuss this question with your friend, then write the answer in your notebook. Do you know why we use the magnifying glass?

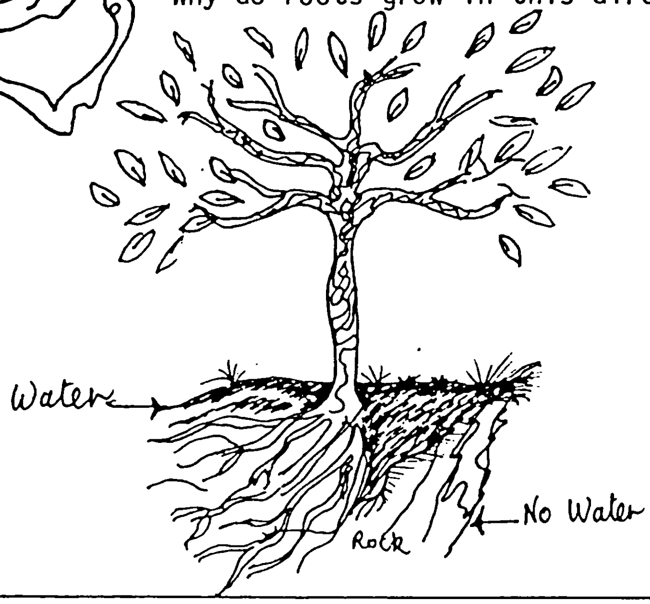


You have learnt that plants, like other living things, need water to live and grow. They can take in water only through their roots. Their roots, therefore, must grow in such a way that they can find water.



Look at this picture and write your answer in your notebook.

Why do roots grow in this direction?

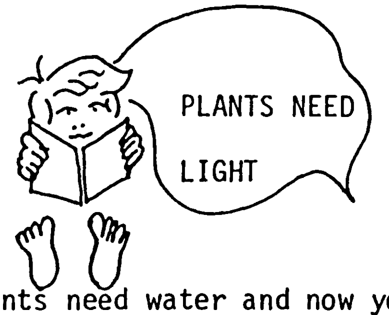


Man and animals can move about to look for water. They can go and live in places where water can be found.

Plants cannot move like animals or man, so plants must send out roots to look for water. In dry places, plants grow very long roots deep into the soil to look for water. The cactus plant grows in the dry desert. It sends out long thin roots deep through the sand to look for water. Plants that grow in water, like papyrus, do not have to look far for water, so they grow short roots in all directions.

Copy this question in your notebook and then answer it.

Why do some plants have short roots?

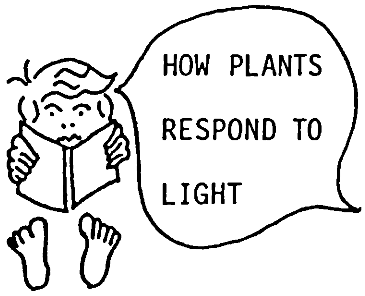


In the previous lesson you studied that plants need water and now you will learn that plants need light to grow. You and your partner can prove this by experimenting. You need:

a. two flower pots
b. soil
c. barley plant
d. water

Now put the soil in the two flower pots and plant the barley plant. Then keep one in natural light and the other in a dark place and water them from time to time, You will see that the plant in the dark place will die after a time. But remember that not all plants need the same amount of light.

Discuss this question with your teacher and then write the answer in your notebook.
How do plants not need the same amount of light?



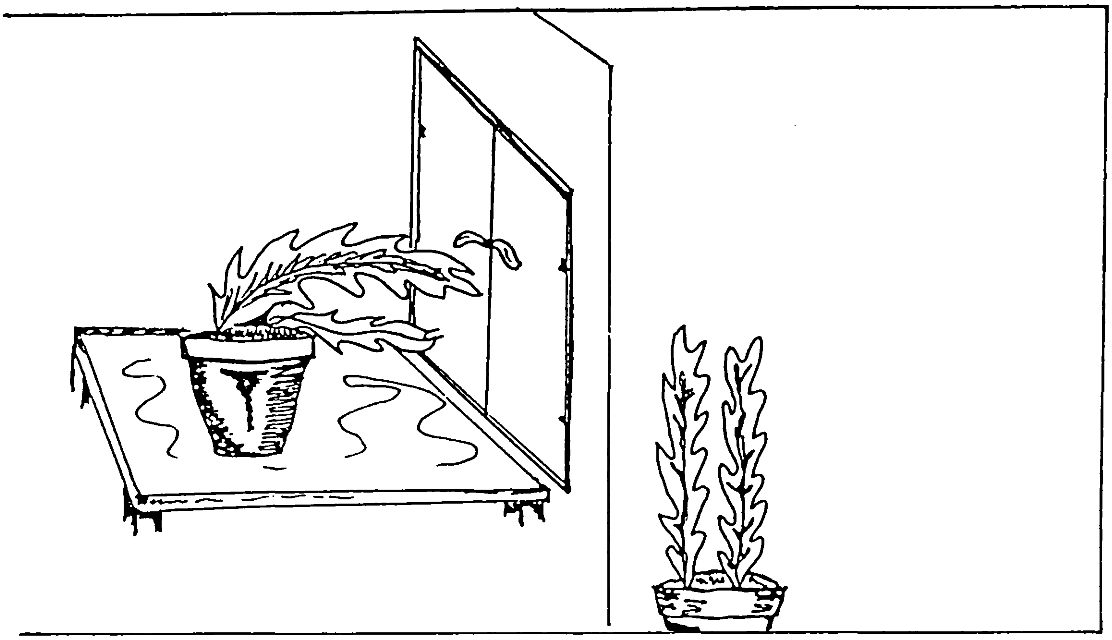
Plants respond to light more than other living things. This is because plants need sunlight to make food and without sunlight they die.

In the forest, where plants grow thickly together, trees grow taller and taller to get sunlight. Have you ever seen tall, straight trees in the forest looking like giants trying to outgrow one another? They are competing for sunlight. Smaller plants growing in the shade of these tall trees do not always get enough sunlight and so in the end they may die.

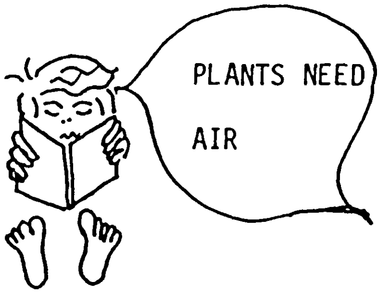
Copy the question in your notebook and then answer it.
Have you noticed that not much grass grows in the shade of big spreading trees? Why?
Discuss this with your friend.

Plants send down roots to look for water. They must also send up stems carrying leaves to look for light. These stems always move towards the light, just as roots always move towards water.

Answer this question in your notebook. Look at the picture below and then write why the plant in the house is bending its stem, but the other, in the garden, grows up straight to the sky.



Stems are not the only parts of a plant that respond to light. Some flowers do so too. The flowers of a daisy open in the morning sun and close in the evening. The sunflower turns its face towards the sun as the earth revolves.

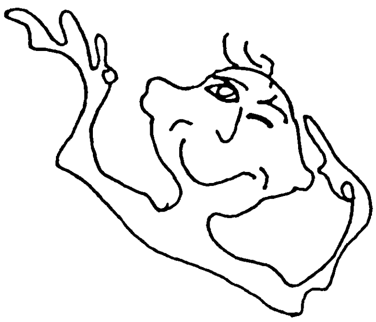


Plants, like other living things, need air. You can prove this by experimenting - watch your teacher doing the experiment. He will need:

a. two flower pots

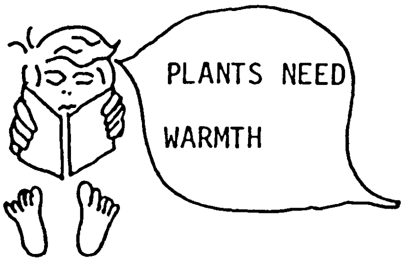
b. a glass container

He takes two flower pots with the same flower, then takes the glass container and puts it over one of them, so that there is no air. You see that the plant which is covered by the glass container soon dies because it is left without air, inspite of water and light.



Discuss with your teacher and then write the answer in your notebook.

Why does the plant need air?



You have learnt that plants, like other living things, need water, sunlight and air.

However, water, sunlight and air by themselves are not enough. Plants, like other living things, also need a certain amount of warmth.

Some trees shed their leaves in Autumn and they do not grow in winter, but they have new leaves in spring.

Prepare a list of some plants which shed their leaves in Autumn and what they are called. If you need help, ask your teacher.

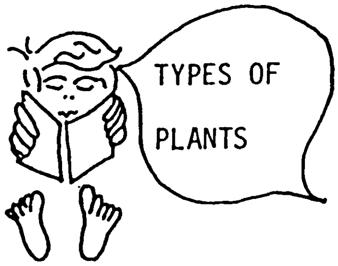
Copy the answer in your notebook.

Every kind of seed grows at a suitable temperature, so you can say that warmth is responsible for plant distribution on earth.

Date plams grow in the south and middle of Iraq, but not in the north, because date plams need more warmth and north Iraq is too cold for them.

Name other trees which do not grow in the north of Iraq. Write your answer in your notebook. Discuss with your friend.

Remember, plants die if there is too much cold or too much heat.



You can easily recognise an animal from its parts. You can tell the difference between a mammal, a bird, a fish and an insect from the different parts which they have - the eyes, the wings, the tail, the fins and so on.

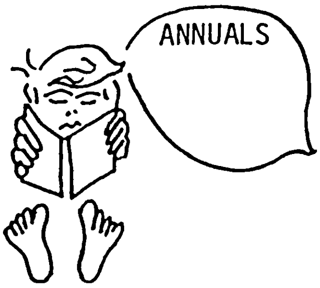
Can you just as easily tell the difference between different types of plants? You can probably recognise some plants from their flowers or their fruits, but did you know that all the thousands of different flowering plants in the world can be grouped into two types. This is done, not by looking at their flowers or fruits, but by finding out how long they live. You can often tell this by looking at the stem.

The two types of plants are:

1. annuals
2. perennials

Copy this question in your notebook and then answer it.

From which parts of the plant can you tell if a plant is annual or perennial?



These are plants which live for only one year or less. That means they grow and die within one year.

Some of them you recognise easily because they are plants that we grow and eat. Wheat is a good example; it grows to about four feet high within one year and then dies.

Other examples are the pea and the tomato plants; other annuals that we grow in our gardens are the marigold and the sunflower.

Copy this question in your notebook and then answer it.

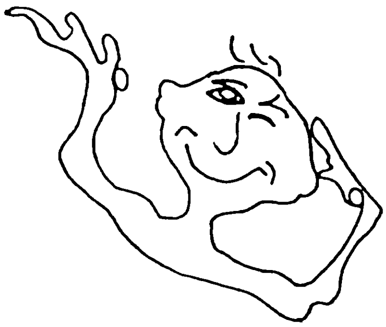
Prepare a list with your partner of names of some annual plants.

Annuals have:

soft and juicy stems

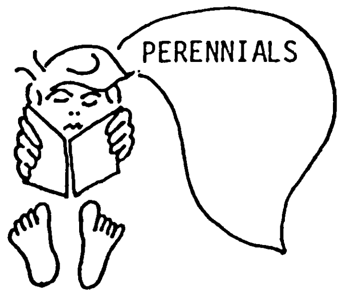
do not grow very tall

have to be supported with sticks



Copy this question in your notebook and then answer it.

Why do annual plants not grow very tall?



Perennials are plants that grow for more than two years. Not all of them are tall. Some perennials are shrubs which do not grow very tall.

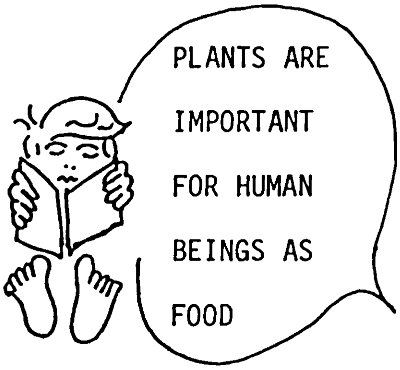
Most perennials have hard, woody stems. Every year the stems get harder and grow thicker until they become trunks and bear branches. Because their trunks are hard and woody, these plants are able to grow very tall without falling over.

Perennials are plants that continue to live and flower after two years. Because perennials live for a long time, most of them grow a hard outer covering to protect their trunks, branches and roots.

Many perennial plants are useful to man. We can eat their fruit, for example, oranges, apples. We can build houses with their wood. We grow them in our gardens and by the roadside for their shade, for example.

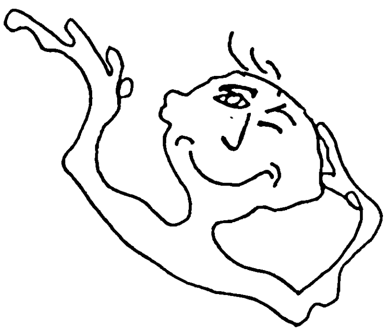
Copy these questions in your notebook and then answer them.

a. Are date plams perennials? Why?
b. Find out, with your partner, names of some perennial trees that grow at your school.

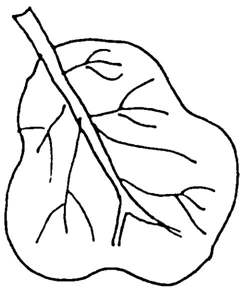


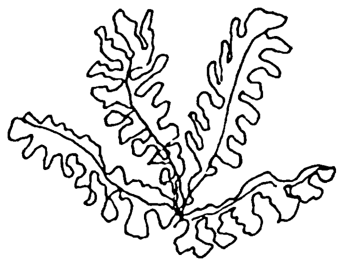
There are many kinds of food you can get from plants. The parts of plants that are eaten can be: seeds, stems, leaves, roots or fruit.

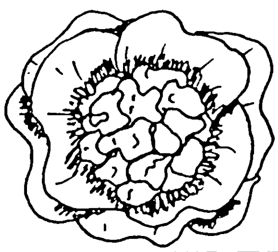
For example, what, beans, barely are seeds; carrots are roots; potatoes are stems; parsley and cabbage are leaves; cauliflower is a flower.



Draw these pictues in your notebook, then colour and label them.

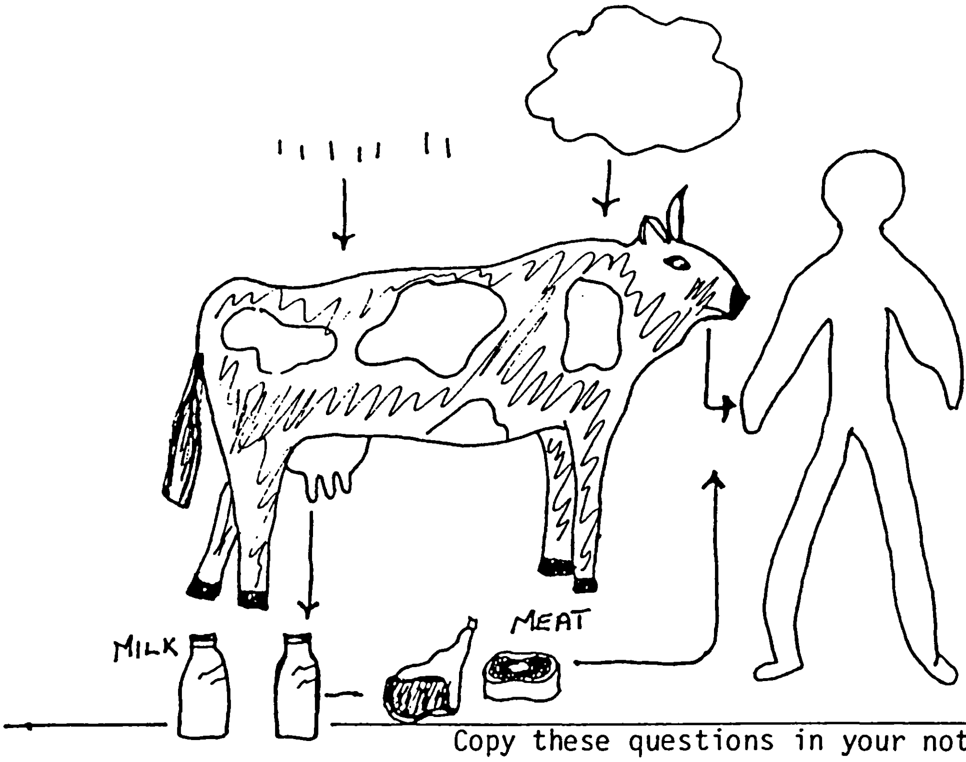






Do you know that meat which you eat also comes from plants? Meat comes from cows, sheep, goats, which all eat plants. If there were no plants, there would be no cows, sheep or goats.

Plants, therefore, are the only living things that can make their own food, and they themselves become food for other living things.



Copy these questions in your notebook and then answer them in a complete sentence:

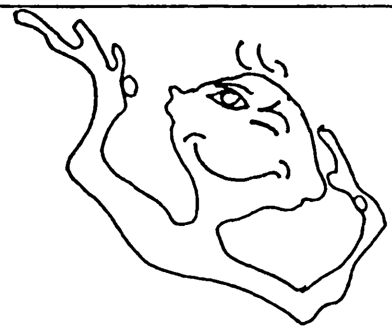
a. an important source of food for humans........

b. what part of parsley, cabbage and spinnach are eaten.......

Prepare with your partner a list of some kinds of food which you get from plants.

If you look at your clothing, you will find that some of it is made of cotton, which is collected from the cotton plant. However, wool comes from sheep and the camel's hair from the camel.

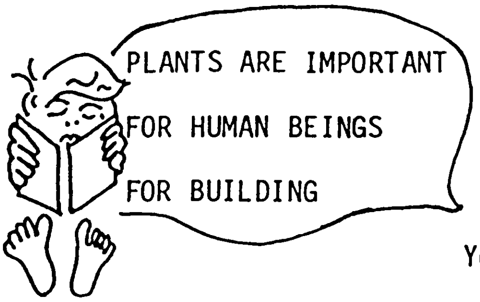
After reading the previous passage and the previous page,



answer this question in your notebook.

Work with your friend.

How is wool developed from the plant?



You are sitting in your class, you look at your desk, blackboard, door, window..... you will find that they are all made from wood.

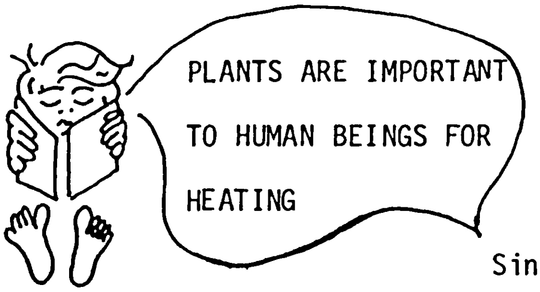
In the village, houses are built from plants, particularly from papyrus and date palms. Sometimes they are built of mud or blocks and the roofs are made of tree branches or date palm leaves. However, the new buildings in the cities are built of steel because steel is stronger than wood.

Your books and notebooks are also made from the core of the trunk and the fibres of the cotton.

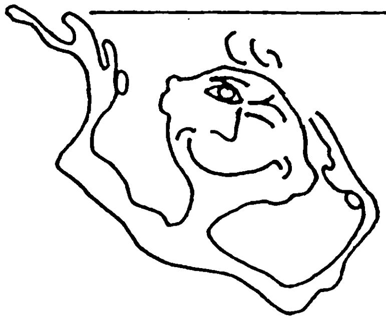
Copy these questions in your notebook and then answer them.

a. Make a list of the furniture in your home which is made from wood.

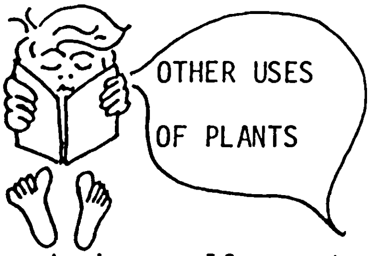
b. What use does man make of the branches of trees?



Since human beings know how to make fires, they use the branches of the trees to burn for heating, cooking, preparing bread and to prepare charcoal.



Discuss with your teacher how human beings prepare charcoal from the plant. Then write the answer in your notebook.



We get tea from some plants and henna for dyeing. If some tea spills on your clothes, you will see that your clothing is stained red. Henna colours your hair if you put it on your hair and leave it for a period of time.

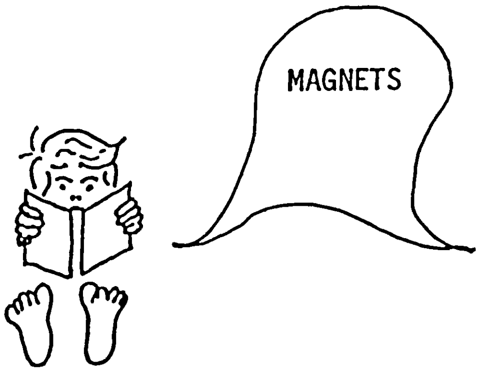
Could you prove by experiment how tea dyes the cloth? Remember you need a bowl, tea and a piece of cloth.

Some medicines are made from plants, like caster oil, which we can get from the chemist. Do you know that the medicine which your mother prepares which is like tea and which she gives you when you get a cold, is from some plants which are grown in the north in Spring?

We also get perfumes from some flowers.

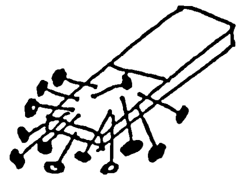
Write in your notebook the names of flowers used to make perfumes. Discuss this with your friend.

Magnetism Unit

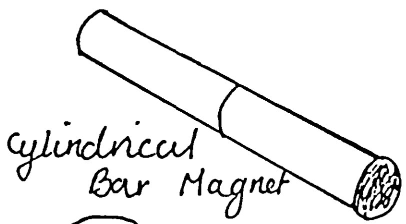


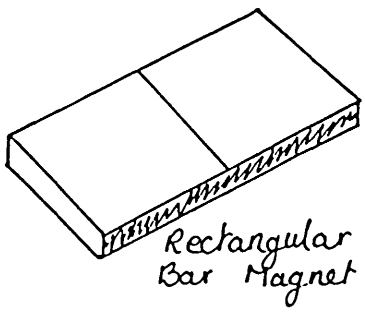
Magnets are pieces of metal which are able to attract iron and steel.

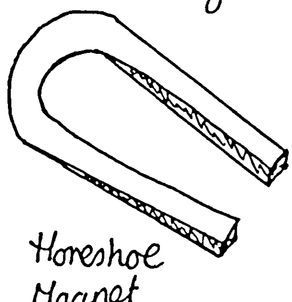
In the diagram on the right you can see how a magnet attracts iron nails.

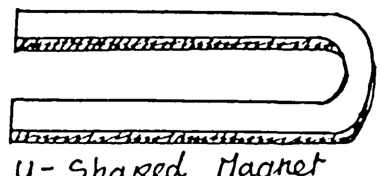


Most magnets are made of iron or steel and they can be made into many different sizes and shapes. In fact, a magnet can be made into any shape. The more common shapes of magnets are shown below:









Draw in your notebook the shapes shown above and label them

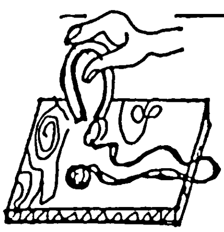
A magnet exerts force when it attracts iron or steel. You can feel this force when you try to pull the iron or steel from the magnet. You can see how strong the force of the magnet is by carrying out this experiment with your friend. You will need:

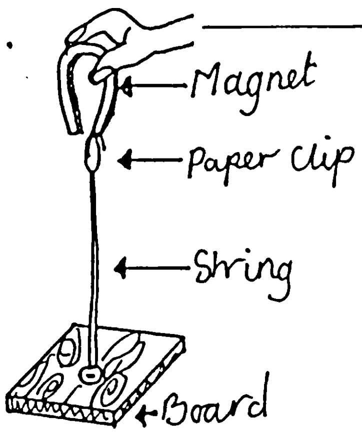
a. string
b. paper clip
c. wooden board
d. drawing pin
e. magnet

Procedure: Tie one end of a string to a paper clip. Attach the other end of the string to a wooden board with a drawing pin. Hold the magnet in one hand and pick up the paper clip with it. Raise the magnet and the paper clip until the string is straight. Carry on raising the magnet until the magnet is separated from the clip, as shown in the diagram. Keep on raising the magnet until the paper clip just begins to fall to the wooden board.

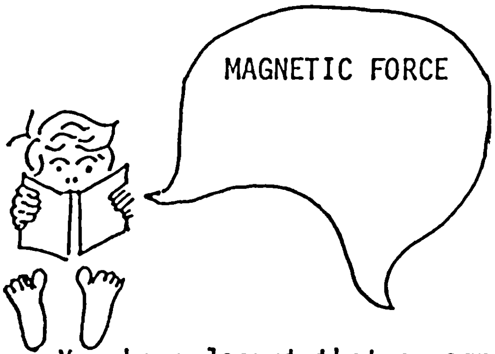
Now:

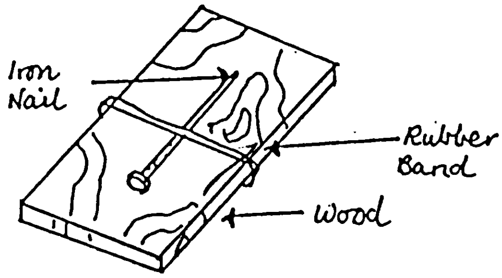
Measure the distance between the lowest point of the magnet and the highest point of the clip. Repeat this twice. Make a copy of the table below in your notebook. Work with your friend.





1st Reading.................cm
2nd Reading.................cm
3rd Reading ....cm





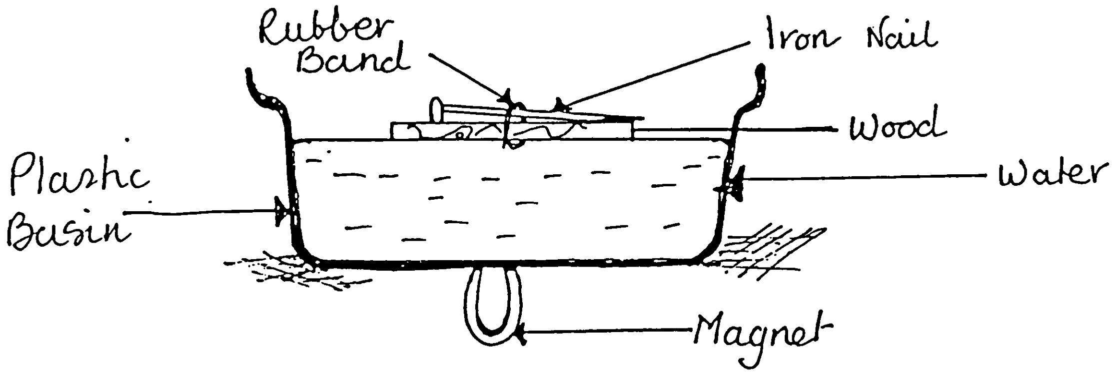
You have learnt that a magnet exerts force. This magnetic force is able to pass through certain substances and attract iron and steel.

The teacher will do an experiment in front of you to show this.

He will need:

a. magnet
b. rubber band
c. iron nail
d. piece of wood
e. plastic basin
f. water

<u>Procedure</u>: Use the rubber band to hold an iron nail to a piece of wood which will float on water. Take the plastic basin and fill it with water. Now float the piece of wood underneath the basin and move it about slowly.



You will see that the wood will move in the same direction as the magnet. This is because the magnetic force is able to pass through the plastic basin and water, to attact the iron nail.

Copy this question in your notebook and then write the answer:

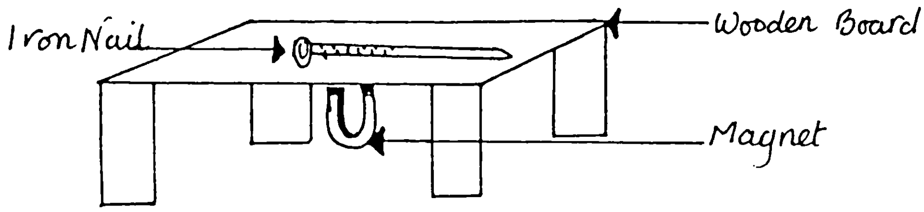
When the teacher holds the magnet further away from the bottom of the basin, does the floating piece of wood move as readily as it did before?

After watching the experiment, see if you can do this by yourselves.

You will need:

a. magnet
b. iron nail
c. wooden board

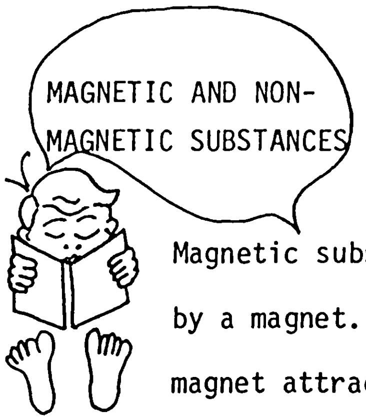
Procedure: Take the iron nail and put it on top of a wooden board. Hold a magnet about 1 cm below the wooden board and move it about. What happens to the nail?



[You will find that the nail will move in the same direction as the magnet. This is because the magnetic force is able to pass through the piece of wood.]

Now use different sheets of material in place of the wooden board. See if the magnetic force is able to pass through them. Make a copy of the table below in your notebook. Record your result with your friend.

1. Plastic...........	4. Iron.............
2. Glass.............	5. Paper............
3. Cardboard.........	6. Rubber...........



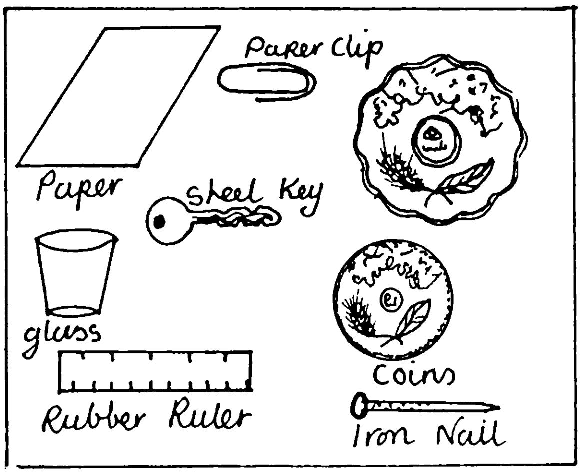
Magnetic substances are things which are attracted by a magnet. They either pull the magnet, or the magnet attracts them.

Non-magnetic substances are things which are not attracted by a magnet. Most of the things in the world are non-magnetic.

Now do an experiment to find out which things in the picture below are magnetic substances and which are non-magnetic substances.

Take a magnet and see which things are attracted by it and which things are not. Work with your partner. Make a copy of the table below in your notebook. Record your result.

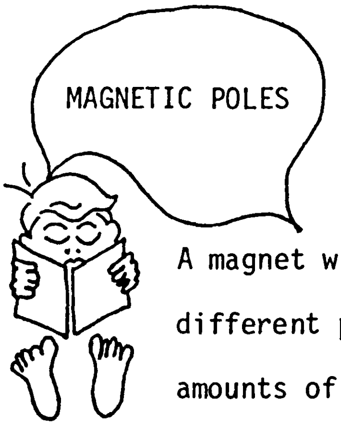
Substance	Magnetic or non-magnetic substance
1. Rubber	non-magnetic
2. Nail	magnetic
3.	
4.	
5.	
6.	
7.	
8.	



Copy these questions in your notebook and then answer them in complete sentences.

a. Write down below some other non-magnetic substances you know of..

b. Write down below some other magnetic substances you know of..

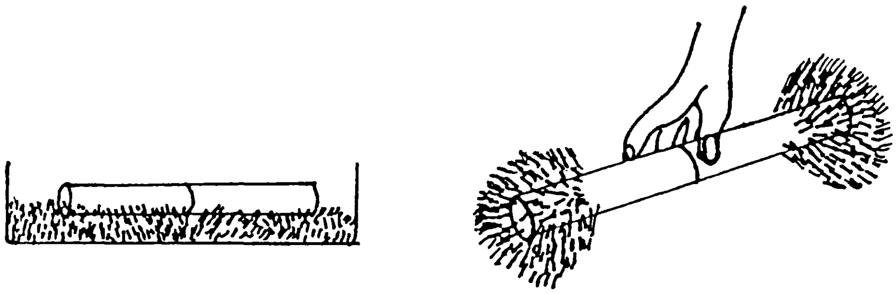


A magnet will attract magnetic substances. However, different parts of a magnet will exert different amounts of magnetic force.

The two ends of a magnet will exert greater amounts of magnetic force than the other parts of a magnet. The middle of the magnet will exert the least force. The two ends of the magnet are called the POLES. If you want to be able to prove it, you will need:

a. magnet
b. clips or iron filings

Procedure: Dip a magnet in paper clips or iron filings. You will find that most of the clips or iron filings will be attracted to the poles of the magnet.



This experiment shows that the ends or poles of the magnet have greater magnetic force than the centre. As you can see, few iron filings or paper clips will be attracted to the middle position.

Copy this question in your notebook and then answer it with your friend.
Do you know why few paper clips or iron filings were attracted to the middle portion of the magnet?

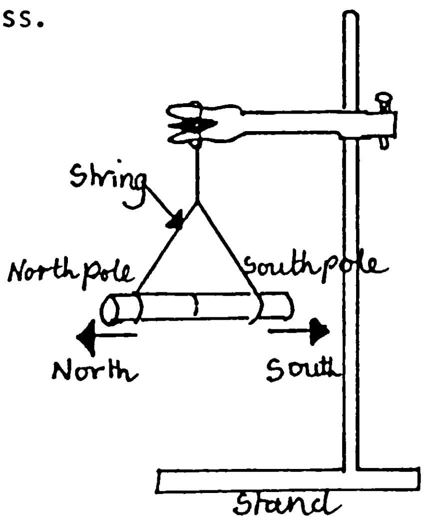
Every magnet has two poles. The two poles are different. One pole is called the North pole. The other pole is called the South pole. Every magnet has a North and a South pole.

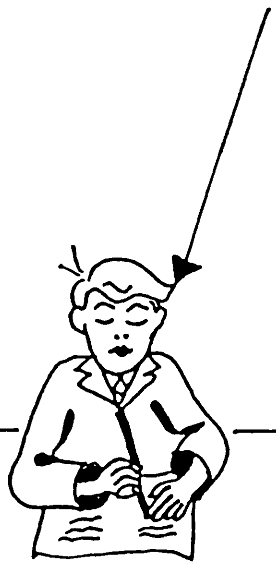
If a magnet is allowed to hang freely it will always hang in a certain direction - the North-South direction.

The North pole will always point towards the North and the South pole will always point to the South. You can find this out for yourself when you do this experiment. Work with your friend. You will need:

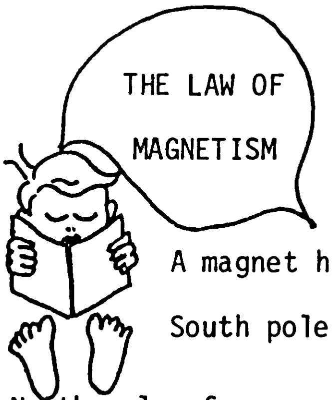
a. magnet
b. string
c. stand

Procedure: Hang a magnet so that it can rotate freely in the air, as shown in the diagram below. When the magnet stops moving, mark the direction of the magnet with a piece of chalk. Mark one pole with a cross. Move the magnet to another position and release it. When the magnet finally stops rotating, note the direction of the pole with a cross.





Has the magnet come back to the former position? Write your conclusion in your notebook. Work with your friend.



A magnet has two different poles: a North and a South pole.

The North pole of a magnet will attract or pull the South pole of another magnet. The South pole will also attract the North pole of another magnet. Therefore, unlike or different poles attract.

The North pole will repel or push away the North pole of another magnet. The South pole will also repel or push the South pole of another magnet. Therefore, like poles will repel.

The law of magnetism is: LIKE POLES REPEL, UNLIKE POLES ATTRACT

If you want to be certain, take a piece of string and two bar magnets. Hang up one magnet with the string so that it can swing freely.

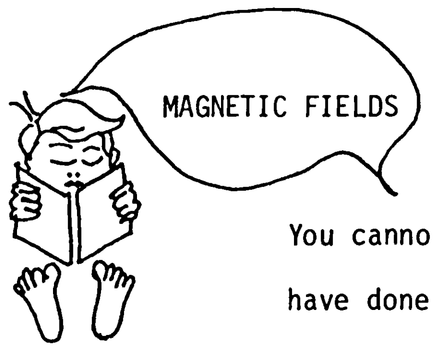
Make sure that there are no magnets or magnetic substances nearby. When the magnet stops rotating:

1. Bring the North pole of the second magnet near the North pole of the hanging magnet. They will repel, because like poles repel.
2. Bring the South pole of the second magnet near the South pole of the hanging magnet. They will repel, because like poles repel.
3. Bring the South pole of the second magnet near the North pole of the hanging magnet. They will attract, because unlike poles attract.

4. Bring the North pole of the second magnet near the South pole of the hanging magnet. They will attract, because unlike pole attract.

Now copy this table in your notebook and then complete it with your partner.

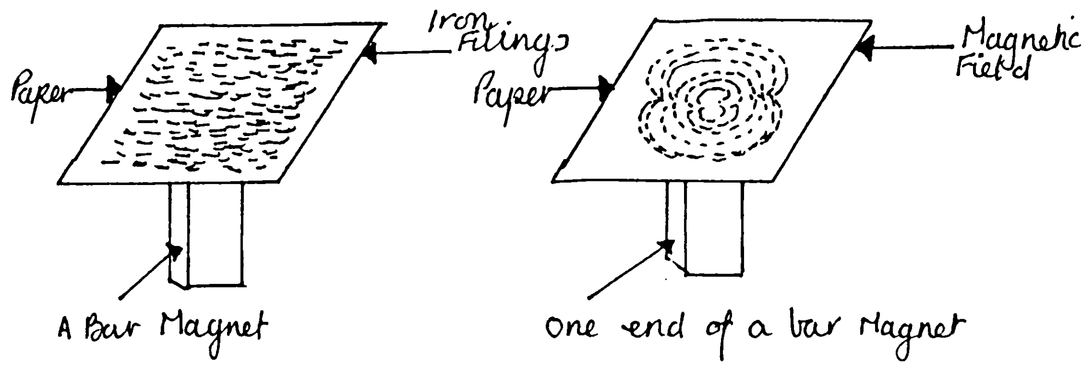
Hanging magnet	Magnet 2	Attracts or repels
1. North pole	North pole	....
2. South pole	North pole	....
3. North pole	South pole	....
4. South pole	South pole	....



You cannot see the magnetic force of a magnet. You have done experiments to show that magnetic force exists around every magnet. The arrangement of magnetic force around a magnet is called its MAGNETIC FIELD. The stronger the magnet, the stronger will be the magnetic force and the bigger will be the magnetic field. Any magnetic substance in the magnetic field will be affected by the magnet. If you want to investigate the magnetic fields, you will need:

a. bar magnet
b. piece of paper
c. iron filings

Procedure: Take the bar magnet and stand it on one end. Hold a piece of paper on top of it. Sprinkle some iron filings on the paper and gently tap the paper. The magnetic field you see traced out by the iron filings is shown below.

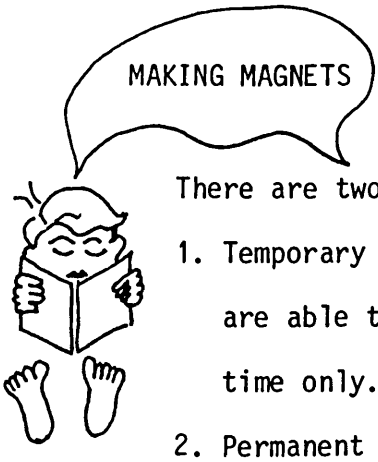


Copy this question in your notebook and then write the answer.

When two poles of different magnets are brought close together, they can also produce a magnetic field. Will the magnetic field produced be different from that produced by a single magnet? Do it, then draw the pattern. (Work with your partner.)

Take two magnets and place them on their ends so that the North pole of one is about 5 cm away from the South pole of the other. Place a paper above the two magnets and sprinkle iron filings on it. Trace the magnetic field produced underneath. Copy this question in your notebook and answer it:

Is the pattern very different from the previous pattern. Why?



There are two main kinds of magnets:

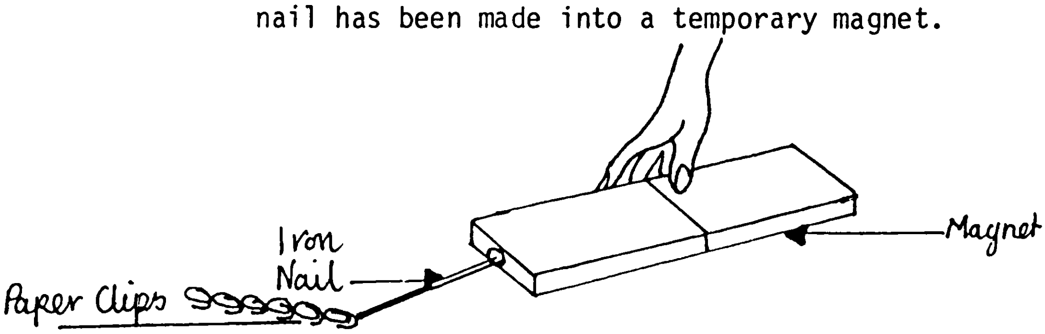
1. Temporary magnets which are made of iron and are able to keep their magnetism for a short time only.
2. Permanent magnets which are made of steel and are able to keep their magnetism for a long time.

To make a temporary magnet you will need:

a. magnet
b. large iron nail
c. paper clips

Procedure: (Work with your friend.) First, show that the iron nail is not a magnet by touching it with some paper clips. The iron nail will not attract the paper clips. Now place the magnet, nail and paper clips in a line, as shown in the diagram below. As you move the clips to the nail you will see that they will be attracted to the temporary magnetic nail.

If you take away the magnet, you will find that the nail loses its magnetism. If you use a very strong magnet, you will find that the iron nail will keep its magnetism only for a short time. Therefore, the iron nail has been made into a temporary magnet.

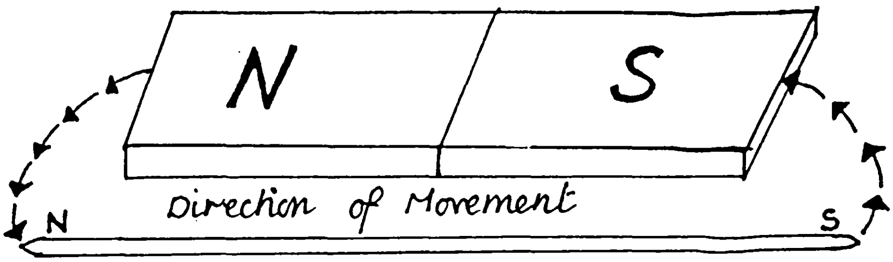


However, if you want to make a permanent magnet, you will need:

a. magnet
b. steel knitting needle
c. paper clips

Procedure: Put the knitting needle on a table and then stroke it with a magnet. Stroke the knitting needle in one direction, from one end of the needle to the other, using the same pole of the magnet all the time. Do this many times.

Make the test to find out whether it has any magnetism or not by trying to pick up some paper clips with it. You will find that the knitting needle has become a magnet and will retain its magnetism for a long time. So you have changed the knitting needle into a permanent magnet.



Copy this question in hour notebook, then answer it with your partner.

What is the difference between the temporary and permanent magnet?

We know that magnets are, in fact, pieces of iron or steel with special properties. You have learnt how to make magnets out of pieces of ordinary iron or steel. Now you will learn that by removing magnetism, magnets will change back into ordinary pieces of iron or steel.

There are two ways to remove magnetism:

1. Removal of magnetism by heating:

   Your teacher will do an experiment in front of you about how the magnetism is removed by heating. First he should test the strength of the magnet by counting the number of paper clips it can pick up. He should then heat the magnet for a short while and then test the strength of the magnet again and count the number of paper clips it is able to pick up. When your teacher repeats this twice, the magnet will not be able to pick up the paper clips.

Copy this question in your notebook and then answer it.
What do you notice from this experiment?

2. Removal of magnetism by hard blows:

   You can do this by taking another magnet and testing its strength by counting the number of paper clips it can pick up.

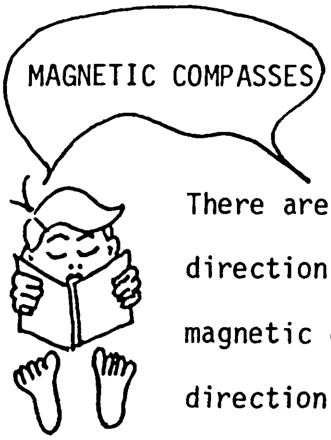
Hit the magnet ten times with a hammer. Now see how many paper coips it can pick up. It picks up less than before.

Copy these questions in your notebook and then answer them:

1. Repeat this twice and see how many paper clips the magnet can pick up each time. Copy this table in your notebook and then record your results.

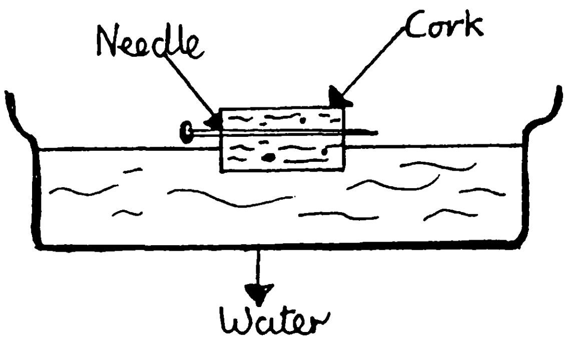
Experiment	Magnet	No. of paper clips picked up
No.1	Without heating	
No.2	10 blows	
No.3	20 blows	
No.4	30 blows	

2. What have you learnt from this experiment?



There are many ways by which we are able to find directions. One of the ways is by the use of a magnetic compass; with a compass we know in which direction we are heading at any time. This is because the compass has a magnet which is allowed to move freely and therefore it will always point in a North-South direction.

You can do this experiment with your friend, by using a bar magnet like a needle. Mark the North pole of the needle. Fix the needle to a piece of cork and float the cork in water. See that there are no magnets or magnetic substances around. When the cork stops moving, the needle will point in a North-South direction.



Copy this question in your notebook and answer it.

What would you use to help you find your direction?

APPENDIX 13

Categories of Language Test

1. Producitivity scale:
   - Total words (TW)
   - Total sentences (TS)
   - Words per sentence (WPS)

- Total words (TW)

The words in a common dictionary were defined as follows: "a sound or combination of sounds, or its written or printed representation, used in a language as a sign of its conception; an element that can stand alone as an utterance. On the basis of this definition all written units recognisable as elements that could stand alone and convey meaning were counted as words." The words might be mis-spelt or even erroneously used, but if recognisable as words, they were included in the word count. On the other hand, a series of letters joined together, but unrecognisable as a word, were excluded and omitted from the word count,

- Total sentences (TS)

Total sentences were included as a measure of productivity (amount of language produced) in the picture story language test. Although there is a relation between Total Words and Total Sentences, so far as language study and clinical diagnosis are concerned, each of these measures provides a different type of information and both are useful. Moreover, this score was necessary because the number of words and the number of sentences must be derived before the words per sentence score can be computed.

Superficially, it seems that counting the number of sentences is a simple process, as indeed it is in most instances. However, when studying the language of young children and of those having disorders of language, the problem often becomes complex. The sentence count is further complicated by the fact that a satisfactory, broadly applicable definition of a sentence is not available, especially in the Arabic language.

- Words per sentence (WPS)

The words per sentence score is readily derived after the total word and the total sentence scores have been determined. It is computed by dividing the number of words (TW) by the number of sentences (TS). This score is the average number of words written per sentence (WPS).

The procedure for deriving the productivity scores is as follows:-

1. Count all the words written, except the titles and others as excluded under the principles for scoring (TW).
2. Divide the story into sentences by inserting a vertical bar at the end of each unit determined as a sentence. Count the number of sentences (TS).
3. Compute the words per sentence score by dividing total words by total sentences (WPS).
4. Record all the scores on the Record Form.

2. Syntax scale:

Language can be measured in three ways: in terms of the amount, or productivity, correctness, and meaning, or content. From this point of view it is form, the conventionalised structure, the arbitrariness, which must be measured by a scale of correctness. It is this peculiarity which we have categorised under the rubric as the syntax scale.

There are three error categories: Word Usage, Word Endings and Punctuation. Spelling was omitted, because errors of this type are of a different order, in as much as they are not involved in correct usage, the syntax scale was devised to measure only the accuracy of language usage.

Within each of the above categories there are specified error types, as follows: Word Usage: additions, omissions, substitutions, word order; Word Endings: additions, omissions, substitutions; Punctuation: additions, omissions, substitutions.

The system for classification of accuracy errors is based on the assumption that words, the principal units of meaning, can be used erroneously in four basic ways. They can be incorrectly added, omitted, or substituted or can be placed in the wrong order. Furthermore, it assumes that words consist of two parts, the root and the ending, and that both are involved in the communication of meaning. Hence, errors might be made in the root or in the ending. In as much as an ending is a different type of error, it should be studied and scored as an error category. Because word endings are rarely placed in the wrong order, errors consist of their being incorrectly added, omitted, or substituted. Punctuation also conveys meaning, so its usage too should be appraised. As with word endings, marks of punctuation are not placed in the wrong order, so incorrectness includes additions, omissions and substitutions.

3. <u>Abstract-concrete scale</u>:

The abstract-concrete scale, designed for evaluating the quality of the ideas being expressed, to some extent parallels the attempts of others to measure meaning or content.

The abstract-concrete scale is divided into five levels, each representing an increment in the extent to which the content of the story manifests use of abstract ideas. With the exception of level 1, meaningless language, the levels are made up of s3veral ranks or subcategories. The score range is from 0 to 25, the higher scores designating greater use of abstraction.

The first step in scoring is to become thoroughly familiar with the scores and the levels they represent. It is necessary to study each category and the subcategories before beginning scoring.

- Level I: meaningless language.

Score 0 The individual has attempted to write words, but they consist only of unrelated letters, or he has written words which he can spell, though they have no relevance to the picture.

- Level II: concrete-descriptive.

There are six subcategories, ranging from a list of the objects observed to ideas involving movement and qualith, expressed through verbs and one or more adjectives. In other words, the range is from simple identification to the use and quality of the objects mentioned, Except for indicating colour, size, or number, the indication is limited to the observable.

- Level III: concrete-imaginative

This level consists of six subcategories ranging from assigning a role to the boy and the girl in the picture to expressing ideas which entail an interaction betseen the boy and the magnet and the girl and the doll. Imaginative indication must be manifested; the ideas are not only descriptive, but are in terms of the observable. The situation protrayed has taken on meaning and the indication reveals significance, relevance, and integration.

- Level IV: abstractive-descriptive

This level assumes that the concepts of time and sequence have been introduced. The temporal relationships need not be consistent throughout the story. The picture remains the focus of the indication expressed, but the story has greater continuity, as manifested by true narrative form; there is portrayal of characters not appearing in the picture. This level consists of five categories, ranging from narration relating to the central figures, the boy and the firl, including expression of sequence and time to stories in which imaginative characters appear, but with the setting as portrayed being retained.

- Level V: abstract-imaginative

The abstract-imaginative represents the highest level of abstract throught measured on this scale. The separate items pictured are unified meaningfully and significantly by expression of a relationship not given by the stimulus per sentence. At this level, the unifying relationship, or the plot, is imaginary. The story is characterised by ideation which is not bound to the observable. It encompasses plot, imaginative settings, metaphorical and allegorical reference, and connotation of moral values. MOreover, there is continuity from beginning to end. Level V consists of eight categories, From the use of a plot with the setting taken at face value to an imaginary setting with use of allegory and moral connotation.

For more details, see Myklebust (1965).

APPENDIX 14

Use of Record Form

Name and sex: Age: Grade:
School:

1. Productivity scale

   Total words (TW):

   Total sentences (TS):

   Words per sentence (WPS):

2. Syntax scale

Error Category

Error type	Word usage (WU)	Word ending (WE)	Punctuation (P)	Totals
Additions				
Omissions				(TO)
Substitutions				
Word order				
TOTALS:	WU	WE	P	(TE)

No. of words (NW) + Total omissions (TO) = Total unit (TU)

Total unit (TU) - Total errors (TE) = Total correct (TC)

$$\frac{TC}{TU} \times 100 = \text{Syntax quotient (SQ)}$$

3. Abstract-concrete

APPENDIX 15

Number of schools according to sex in the three areas*

Name of the areas	Boys	Girls	Mix	Total
Mansour	46	25	117	188
Adamyia	19	2	153	174
Saddam City	47	7	203	257
TOTAL:	112	34	473	619

Number of pupils in each area*

Area	Boys	Girls	Total
Mansour	36773	40113	76886
Adamyia	16814	15360	32174
Saddam City	92602	82158	174760
TOTAL:	146189	137631	283820

*These figures were taken from the Ministry of Education, Department of Statistics.

APPENDIX 16

Summary of teachers' condition (judged in relation to the reliability of the language test)

No.	Qualification	In-service training	Years served	Year of birth
1	College of Arts, Arabic language four years after Secondary School	3 months	8	1952
2	College of Arts, Psychology and Education four years after Secondary School	6 months	18	1945

APPENDIX 17

Parents' Education Level

The social economic status was measured by the education level of the father and mother. Below is the education of the pupils' parents in the six schools:

Education level	No. of pupils' fathers	No. of pupils' mothers
Illiterate	23	70
Can read and write	34	25
Graduate from primary school	26	21
Graduate from middle school	14	7
Graduate from secondary school	15	2
Graduate from institute	1	zero
Graduate from university	13	1

APPENDIX 18

*The results of the F test for the matched grades of the fourth grade of the written language test

Schools	TW	TS	WPS	SQ	AC	HD	IQ	dF
1 6	0.02	0.08	0.19	0.40	zero	0.71	zero	12
2 4	0.02	0.05	0.08	zero	0.20	zero	0.96	14
3 5	0.00	zero	0.02	0.05	0.37	zero	zero	12

*The results of the F test for the matched grades of the fifth grade of the written language test

Schools	TW	TS	WPS	SQ	AC	HD	IQ	dF
1 6	zero	zero	zero	0.28	zero	zero	zero	6
2 5	0.06	0.70	0.99	0.19	0.92	zero	0.01	10
3 4	0.01	0.01	0.00	0.59	0.24	0.02	0.03	10

*The results of the F test for the matched grades of the sixth grade of the written language test

Schools	TW	TS	WPS	SQ	AC	HD	IQ	dF
1 6	zero	zero	zero	zero	0.32	zero	0.02	18
2 5	0.00	0.01	0.00	zero	zero	zero	zero	10
3 4	zero	zero	zero	0.63	0.00	zero	zero	16

*All the results are non significant at level 0.01.

APPENDIX 19

The product-moment coefficient of correlation

The standard kind of coefficient of correlation and the one most commonly computed is Pearson's product-moment coefficient. The basic formula is:

$$r_{xy} = \frac{\Sigma XY}{NS_x S_y}$$

where r_{xy} = correlation between x and y

x = deviation of an x score from the mean of x scores

y = deviation of a corresponding y from the mean of y scores

ΣXY = sum of all the products of deviations, each X deviation times its corresponding Y deviation

S_x and S_y = standard deviations of the sample distributions of x and y scores.

APPENDIX 20

t-test formula

t-test formula - for one group taking the same test on two occasions

$$t = \frac{M_2 - M_1}{\hat{\sigma}_D}$$

M_2 = mean score on post test
M_1 = mean score on pre test
$\therefore$ $M_2 - M_1$ is numerically equal to mean of gain scores between a pre and post test

$\hat{\sigma}_D$ = standard error of gain scores (d)

where $\hat{\sigma}_D = \frac{\hat{\sigma}}{\sqrt{n}}$ and $\hat{\sigma} = \sqrt{\frac{s'd^2}{n-1}}$ when

$$s'd^2 = sd^2 - \frac{(sd)^2}{n}$$

APPENDIX 21

The pre- and post-test raw scores in mathematics of the three experimental schools by grade

School	Grade Four Pupil No.	Grade Four Scores Pre	Grade Four Scores Post	Grade Five Pupil No.	Grade Five Scores Pre	Grade Five Scores Post	Grade Six Pupil No.	Grade Six Scores Pre	Grade Six Scores Post
1	1	40	99	1	40	100	1	40	100
	2	20	85	2	20	100	2	20	98
	3	60	100	3	60	100	3	40	100
	4	20	100	4	20	100	4	20	100
	5	20	85				5	zero	90
	6	20	100				6	40	100
	7	40	100				7	40	100
							8	40	87
							9	20	85
							10	20	82
2	1	60	100	1	70	100	1	40	94
	2	40	80	2	40	100	2	40	100
	3	40	100	3	40	100	3	40	100
	4	20	90	4	60	100	4	40	95
	5	60	100	5	40	100	5	40	94
	6	40	100	6	40	100	6	40	93
	7	60	88						
	8	20	100						
3	1	40	100	1	60	88	1	20	100
	2	zero	90	2	60	100	2	40	88
	3	60	100	3	20	90	3	40	91
	4	60	100	4	60	95	4	40	100
	5	60	90	5	60	100	5	40	100
	6	60	100	6	40	100	6	40	92
	7	60	100				7	40	100
							8	40	88
							9	40	91

The pre- and post-test raw scores in mathematics of the three control schools by grade

School	Grade Four Pupil No.	Grade Four Scores Pre	Grade Four Scores Post	Grade Five Pupil No.	Grade Five Scores Pre	Grade Five Scores Post	Grade Six Pupil No.	Grade Six Scores Pre	Grade Six Scores Post
4	1	60	25	1	60	30	1	40	30
	2	60	20	2	60	55	2	40	35
	3	20	20	3	60	50	3	40	35
	4	20	45	4	60	40	4	40	40
	5	60	48	5	40	20	5	40	30
	6	60	55	6	40	30	6	40	25
	7	40	20				7	40	58
	8	40	25				8	40	30
							9	40	50
5	1	40	25	1	60	55	1	40	50
	2	40	40	2	40	40	2	40	20
	3	60	60	3	60	50	3	40	20
	4	60	50	4	60	40	4	40	40
	5	60	30	5	60	20	5	40	35
	6	60	40	6	60	30	6	40	40
	7	60	30						
6	1	60	35	1	60	60	1	40	30
	2	zero	35	2	60	60	2	40	30
	3	60	38	3	40	45	3	40	40
	4	40	40	4	60	55	4	40	60
	5	60	50				5	40	60
	6	60	25				6	40	50
	7	60	50				7	40	45
							8	40	50
							9	40	25
							10	40	25

APPENDIX 22

The mean scores ($\bar{x}$) of the spoken language pre- and post-tests for the three grades in the experimental group

Test	TW		TS		WPS		SQ		AC	
Grade	pre-	post-	pre-	post-	pre-	post-	pre-	post-	pre-	post-
4	18.02	53.12	3.34	8.42	6.48	6.64	51.82	81.79	1.87	5.97
5	19.44	60.53	4.44	9.42	4.34	7.04	55.27	87.35	1.55	5.64
6	26.30	58.02	4.40	9.61	6.34	8.11	61.90	86.06	1.75	5.84

The mean scores ($\bar{x}$) of the spoken language pre- and post-tests for the three grades in the control group

Test	TW		TS		WPS		SQ		AC	
Grade	pre-	post-	pre-	post-	pre-	post-	pre-	post-	pre-	post-
4	17.73	18.14	3.13	2.79	6.99	7.33	53.93	53.12	1.73	1.72
5	20.25	21.07	3.67	3.75	5.71	5.84	53.83	54.30	1.95	2.00
6	28.40	28.74	4.44	4.44	7.06	6.89	60.27	59.44	2.28	2.26

The mean scores ($\bar{x}$) of the written language pre- and post-tests for the three grades in the experimental group

Test	TW		TS		WPS		SQ		AC	
Grade	pre-	post-	pre-	post-	pre-	post-	pre-	post-	pre-	post-
4	13.44	63.26	1.42	6.65	5.14	9.83	52.89	85.39	5.05	9.60
5	19.39	85.19	4.22	8.75	5.10	9.90	65.04	84.55	3.69	9.19
6	25.65	65.32	5.68	7.63	4.96	8.97	65.29	87.83	7.17	12.75

The mean scores ($\bar{x}$) of the written language pre- and post-tests of the three grades in the control group

Test	TW		TS		WPS		SQ		AC	
Grade	pre-	post-	pre-	post-	pre-	post-	pre-	post-	pre-	post-
4	10.19	12.73	2.91	3.20	4.99	4.73	52.32	52.80	5.41	4.45
5	19.11	19.08	4.39	3.97	4.86	4.67	63.04	54.34	3.69	3.81
6	25.71	19.64	5.73	4.40	4.94	4.91	63.90	56.04	7.23	5.02

The mean scores ($\bar{x}$) of the attainment pre- and post-tests of the three grades in the experimental group

Grade	Mathematics test		Science test	
	pre-	post-	pre-	post-
4	40.03	95.63	zero	94.21
5	43.89	98.50	zero	94.75
6	35.26	94.88	zero	95.11

The mean scores ($\bar{x}$) of the attainment pre- and post-tests of the three grades in the control group

Grade	Mathematics test		Science test	
	pre-	post-	pre-	post-
4	49.29	36.85	zero	36.17
5	55.00	43.89	zero	36.33
6	40.00	37.56	zero	39.91

APPENDIX 23*

The pre- and post-test mean scores of the matched groups for the fourth grade in spoken language

Test	TW		TS		WPS		SQ		AC	
Schools	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	15.00	58.43	2.57	9.00	6.80	6.86	46.95	82.85	2.29	6.14
6	14.00	14.57	2.43	2.43	7.23	6.37	51.53	51.80	1.71	0.88
2	17.50	44.50	2.88	7.13	7.90	6.51	55.05	84.44	1.63	5.63
4	17.63	18.13	2.38	2.38	8.61	9.06	56.28	55.42	1.63	1.75
3	21.57	56.43	4.57	9.14	4.74	6.56	53.46	78.07	1.43	6.14
5	21.57	21.71	4.57	3.57	5.13	6.56	53.99	52.14	1.71	1.71

The pre- and post-test mean scores of the matched groups for the fifth grade in spoken language

Test	TW		TS		WPS		SQ		AC	
Schools	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	19.00	60.25	4.50	10.25	3.35	6.02	58.64	89.24	1.50	5.25
6	20.75	22.00	4.00	4.25	5.09	5.10	57.00	56.79	2.00	2.00
2	19.33	56.17	4.33	7.50	5.07	8.56	49.70	84.83	1.33	5.33
5	19.33	19.67	3.50	3.50	5.89	5.82	49.20	49.59	1.67	1.83
3	20.00	65.17	4.50	10.50	4.59	6.53	57.48	87.97	1.83	6.33
4	20.67	21.50	3.50	3.50	6.15	6.59	55.30	59.51	2.17	2.17

The pre- and post-test mean scores of the matched groups for the sixth grade in spoken language

Test	TW		TS		WPS		SQ		AC	
Schools	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	14.50	53.00	3.70	10.60	4.59	10.30	55.12	83.22	2.30	4.80
6	21.60	22.10	3.00	3.20	7.53	7.34	56.92	55.94	2.00	2.10
2	33.83	52.17	4.50	8.67	8.53	6.61	59.13	87.35	1.50	5.50
5	37.17	38.00	5.33	5.67	8.10	7.14	59.28	57.51	2.83	2.67
3	30.56	68.89	5.00	9.56	5.89	7.43	71.44	87.60	1.44	7.22
4	26.44	26.11	5.00	4.44	5.56	6.20	64.61	64.86	2.00	2.00

*All of the data from the tests were prepared for statistical analysis in the computer. The data presented are from the computer data; obviously $\bar{x}$ and standard deviation (DS) cannot be measured this accurately.

The pre- and post-test mean scores of the matched groups for the fourth grade, written language

Test	TW		TS		WPS		SQ		AC	
School	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	16.29	61.57	3.71	7.71	4.47	9.39	51.95	89.46	6.29	8.29
6	15.89	12.00	3.86	3.00	4.17	4.09	49.18	50.33	6.29	3.57
2	13.75	64.50	2.88	5.80	4.87	11.29	53.28	83.91	6.00	10.50
4	14.25	12.63	3.00	2.88	5.21	4.80	53.28	60.82	6.50	5.63
3	10.29	55.71	1.86	6.43	6.07	8.82	53.44	82.81	2.86	10.00
5	10.43	13.57	1.86	3.71	5.60	5.29	54.51	47.25	3.43	4.14

The pre- and post-test mean scores of the matched groups for the fifth grade, written language

Test	TW		TS		WPS		SQ		AC	
School	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	19.00	88.75	4.00	9.75	4.71	9.09	63.22	86.56	4.25	9.75
6	19.00	15.75	4.00	2.75	4.71	4.21	59.81	57.86	4.25	3.25
2	20.83	83.33	4.33	7.50	5.03	11.28	62.17	84.67	2.33	8.50
5	20.50	20.83	5.00	5.50	4.38	4.00	64.10	59.47	2.83	3.17
3	18.33	83.50	4.33	9.00	5.56	9.34	69.72	82.42	4.50	9.33
4	17.83	20.67	4.17	3.67	5.49	5.80	65.20	45.70	4.00	5.00

The pre- and post-test mean scores of the matched groups for the sixth grade, written language

Test	TW		TS		WPS		SQ		AC	
School	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	22.90	69.90	5.70	8.00	4.18	9.13	55.83	85.04	6.50	13.80
6	22.90	21.80	5.70	4.60	4.18	5.24	55.83	53.80	6.80	5.40
2	21.50	56.83	4.67	6.33	5.80	9.65	63.41	88.86	6.33	11.67
5	21.67	18.33	4.83	4.17	5.74	4.97	63.41	60.80	6.33	5.00
3	32.56	69.22	6.67	8,56	4.90	8.13	76.64	89.60	8.76	12.78
4	32.56	18.78	6.67	4.44	4.90	4.51	72.45	53.51	8.56	4.67

The pre- and post-test mean scores in mathematics attainment test of the matched groups for the fourth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	31.43	95.00
6	48.50	39.00
2	42.50	94.75
4	45.00	32.25
3	48.57	97.14
5	54.29	39.29

The pre- and post-test mean scores in mathematics attainment test of the matched groups for the fifth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	35.00	100.00
6	55.00	55.00
2	46.67	100.00
5	56.67	39.17
3	50.00	95.50
4	53.33	37.50

The pre- and post-test mean scores in mathematics attainment test of the matched groups for the sixth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	28.00	94.20
6	40.00	41.50
2	40.00	96.00
5	40.00	34.17
3	37.78	94.44
4	40.00	37.00

The pre- and post-test mean scores in science attainment test of the matched groups for the fourth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	zero	94.14
6	zero	40.57
2	zero	95.63
4	zero	36.50
3	zero	92.86
5	zero	31.43

The pre- and post-test mean scores in science attainment test of the matched groups for the fifth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	zero	92.75
6	zero	44.00
2	zero	97.83
5	zero	33.33
3	zero	93.67
4	zero	31.67

The pre- and post-test mean scores in science attainment test of the matched groups for the sixth grade

Test Schools	Pre-test ($\bar{x}$)	Post-test ($\bar{x}$)
1	zero	92.90
6	zero	39.20
2	zero	98.33
5	zero	44.67
3	zero	94.11
4	zero	34.67

APPENDIX 24

The results of the observation of the three grades
in mathematics and science

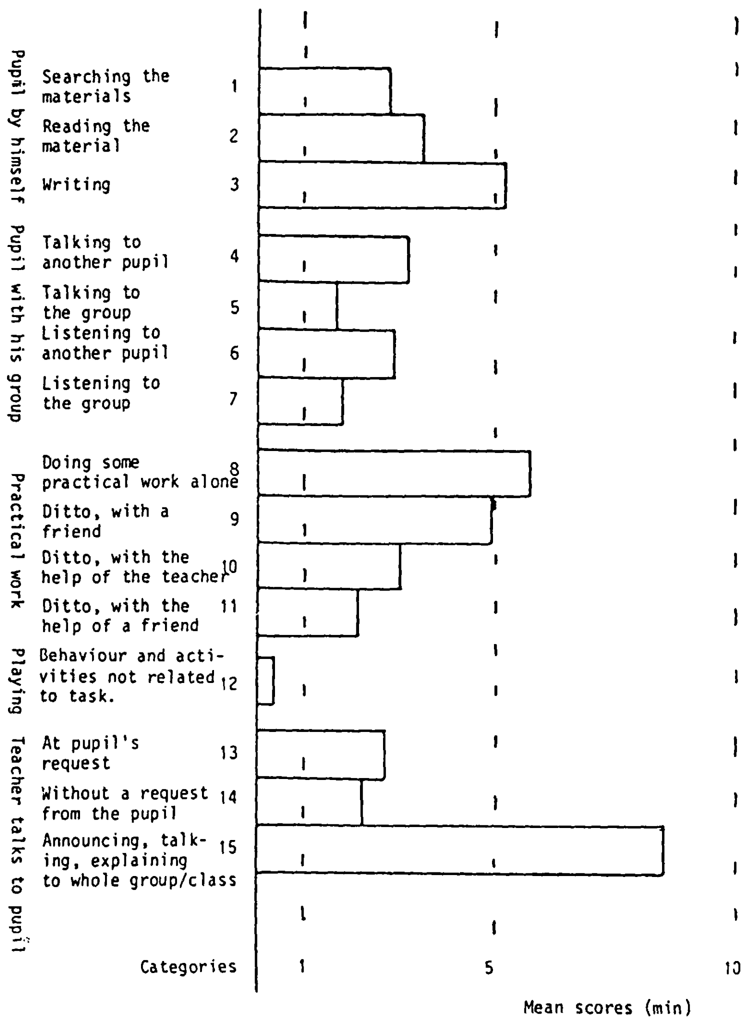


Figure No. 8 Mean scores of 22 4th grade pupils in 3 schools
First observation of 50 minutes science lesson

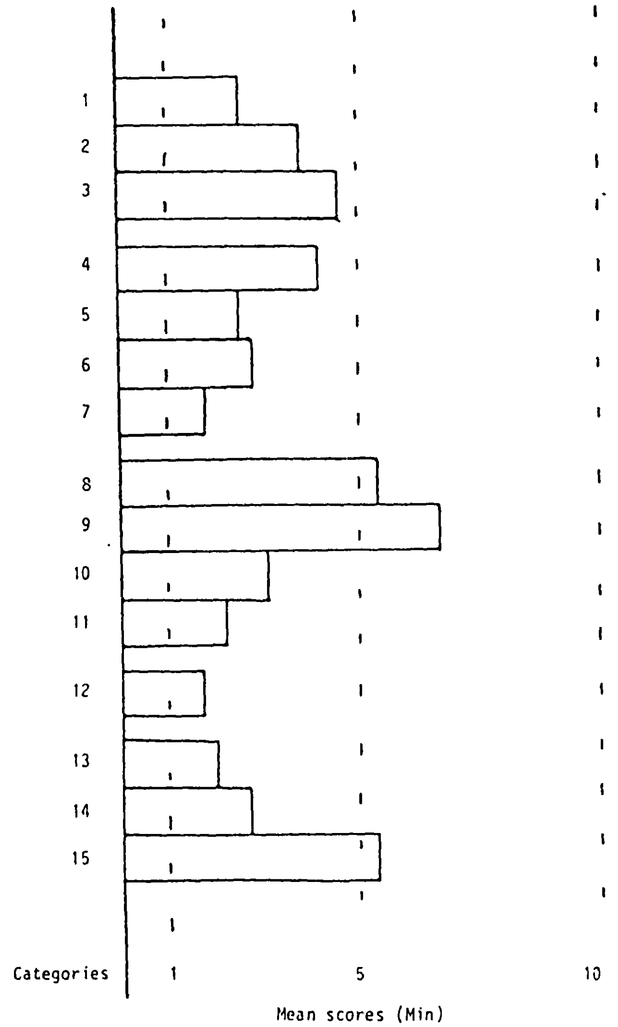


Figure No. 9 Mean scores of 22 4th grade pupils in 3 schools
Second observation of 50 minutes science lesson

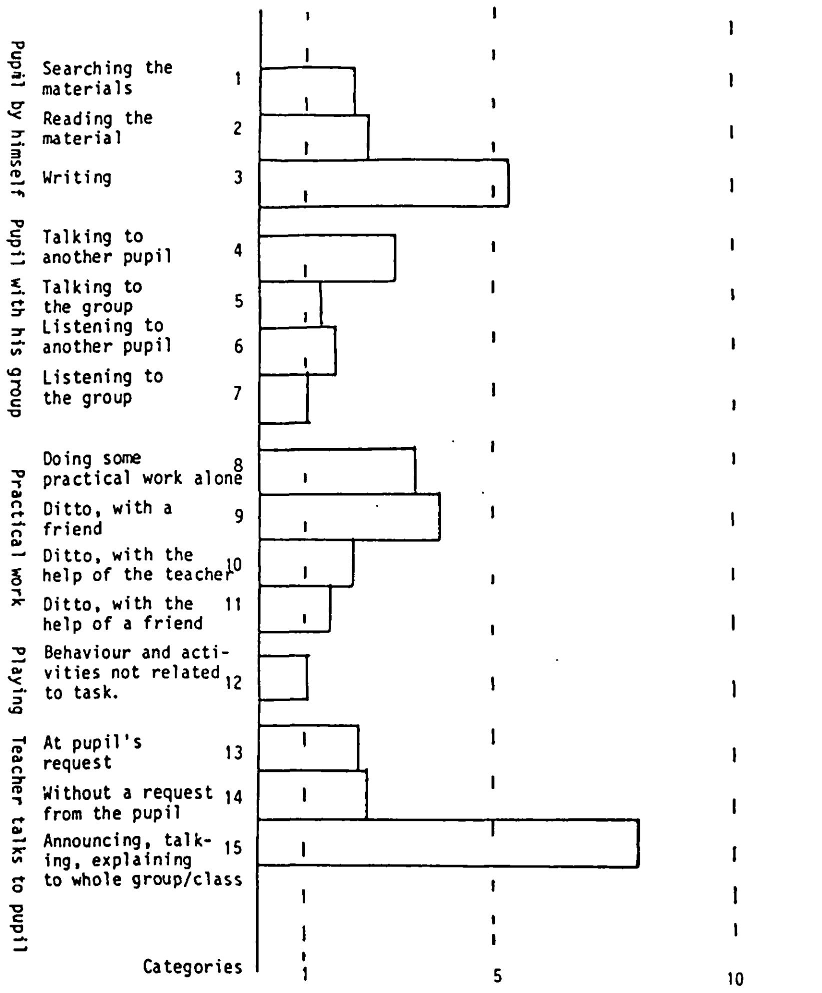


Figure No. 10 Mean scores of 16 5th grade pupils in 3 schools
First observation of 40 minutes mathematics lesson

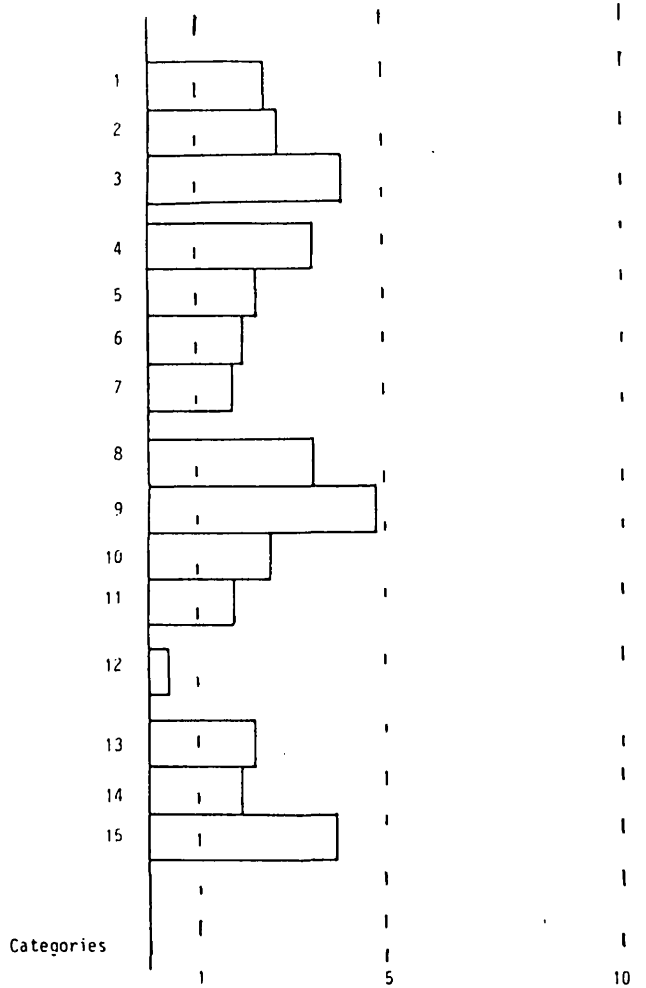


Figure No. 11 Mean scores of 16 5th grade pupils in 3 schools
Second observation of 40 minutes mathematics lesson

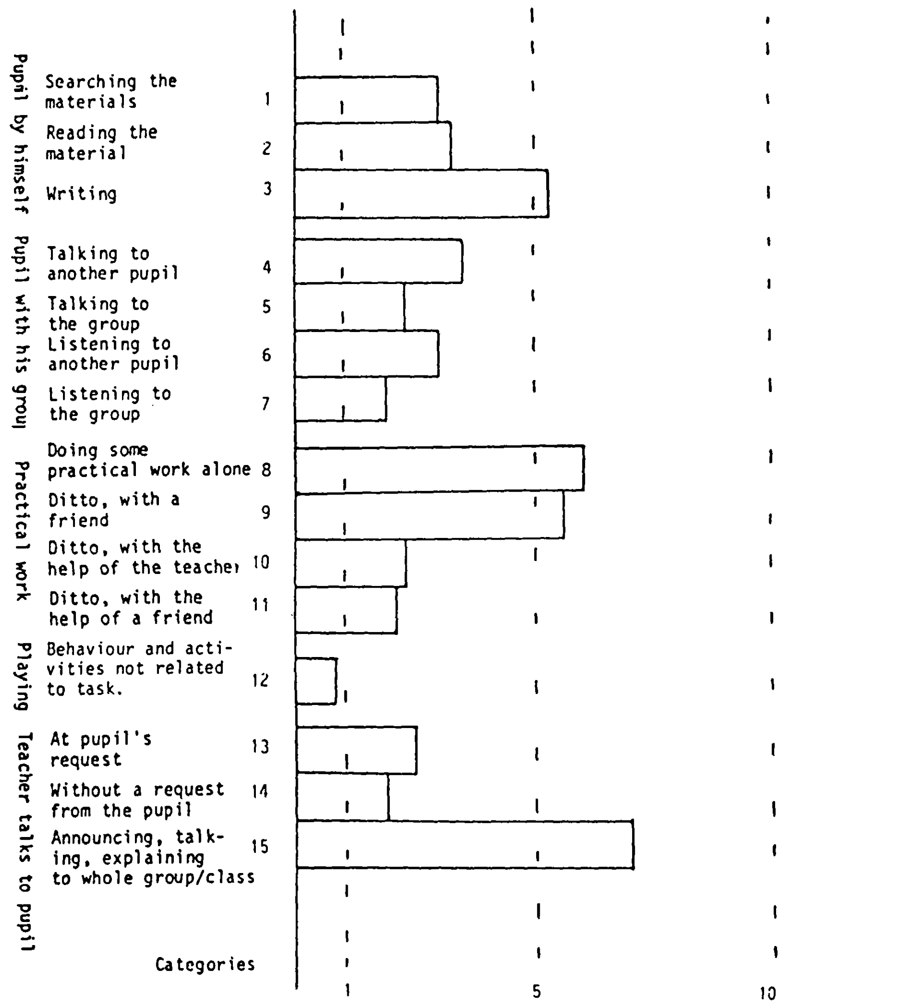


Figure No.12 Mean scores of 16 5th grade pupils in 3 schools
First observation of 50 minutes in science lesson

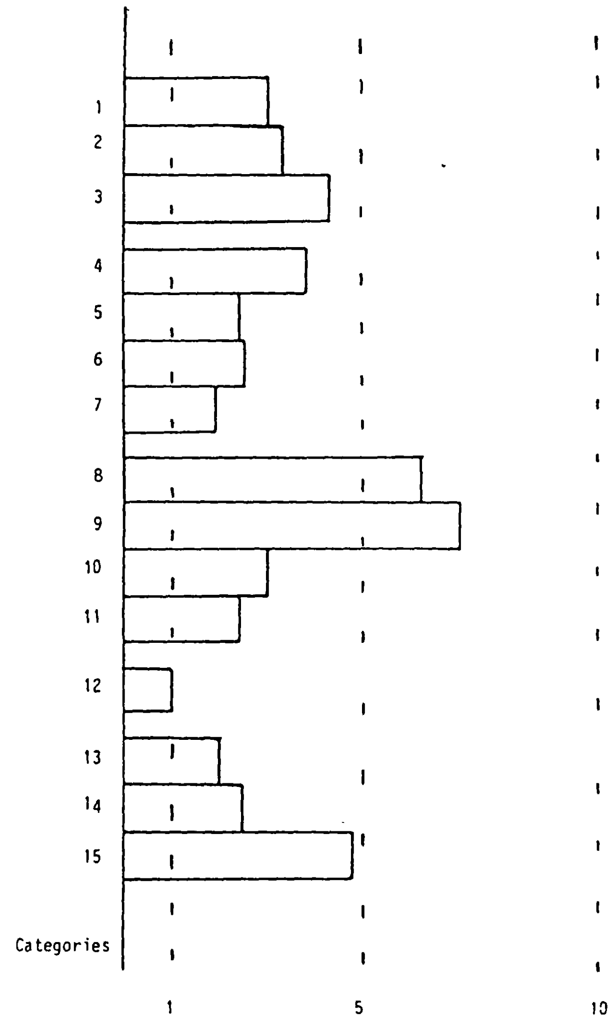


Figure No. 13 Mean scores of 15 5th grade pupils in 3 schools
Second observation of 50 minutes in science lesson

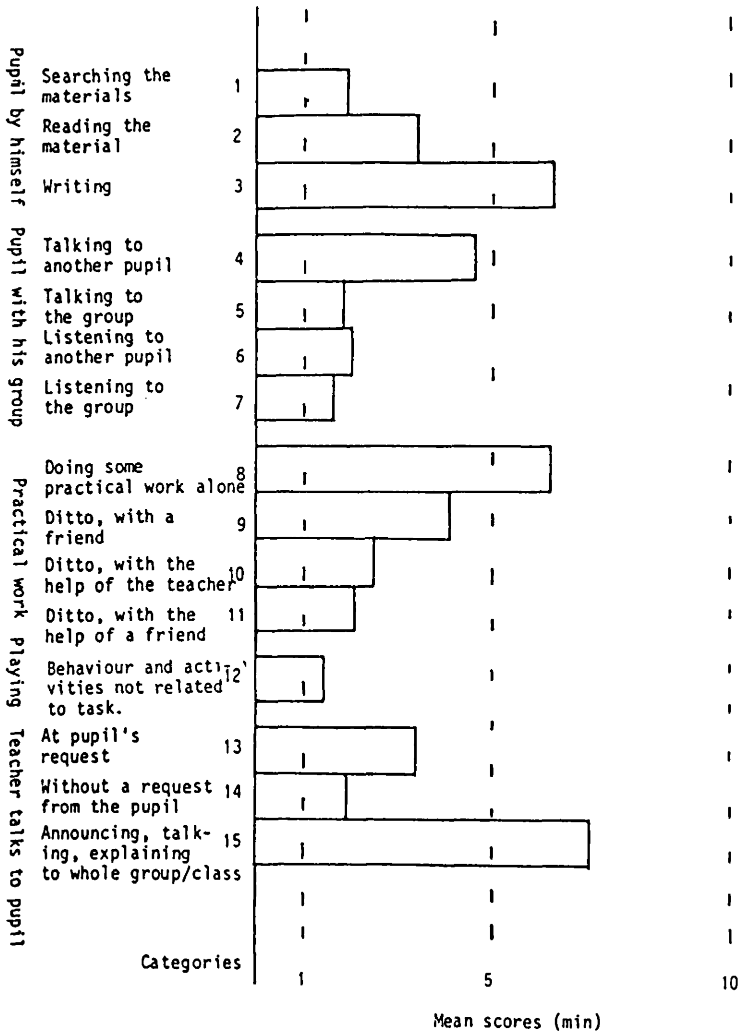


Figure No. 14 Mean scores of 25 6th grade pupils in 3 schools
First observation of 50 minutes mathematics lesson

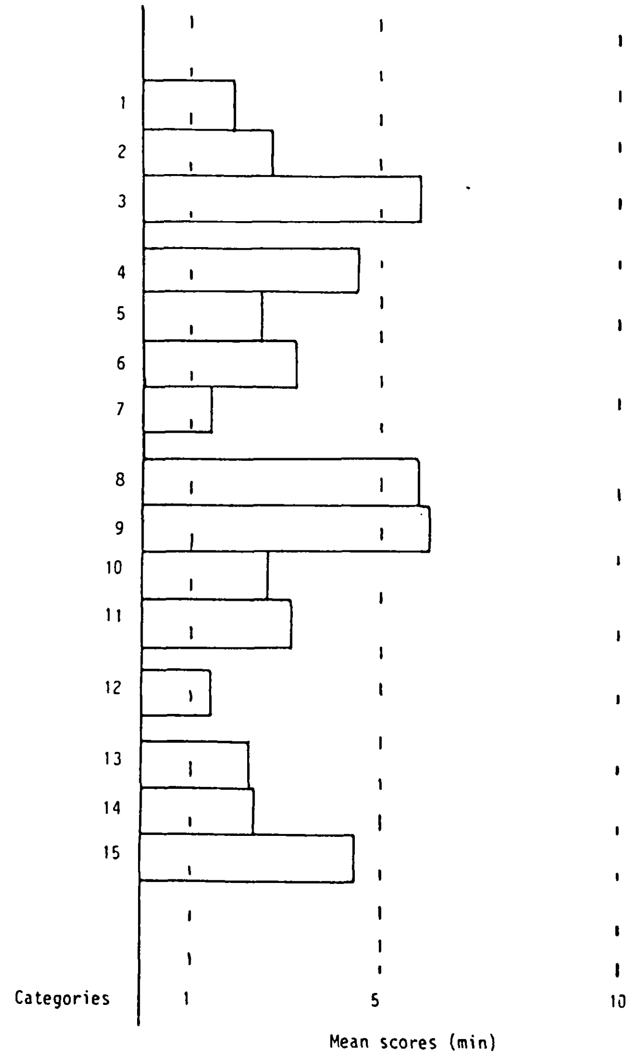


Figure No. 15 Mean scores of 25 6th grade pupils in 3 schools
Second observation of 50 minutes mathematics lesson

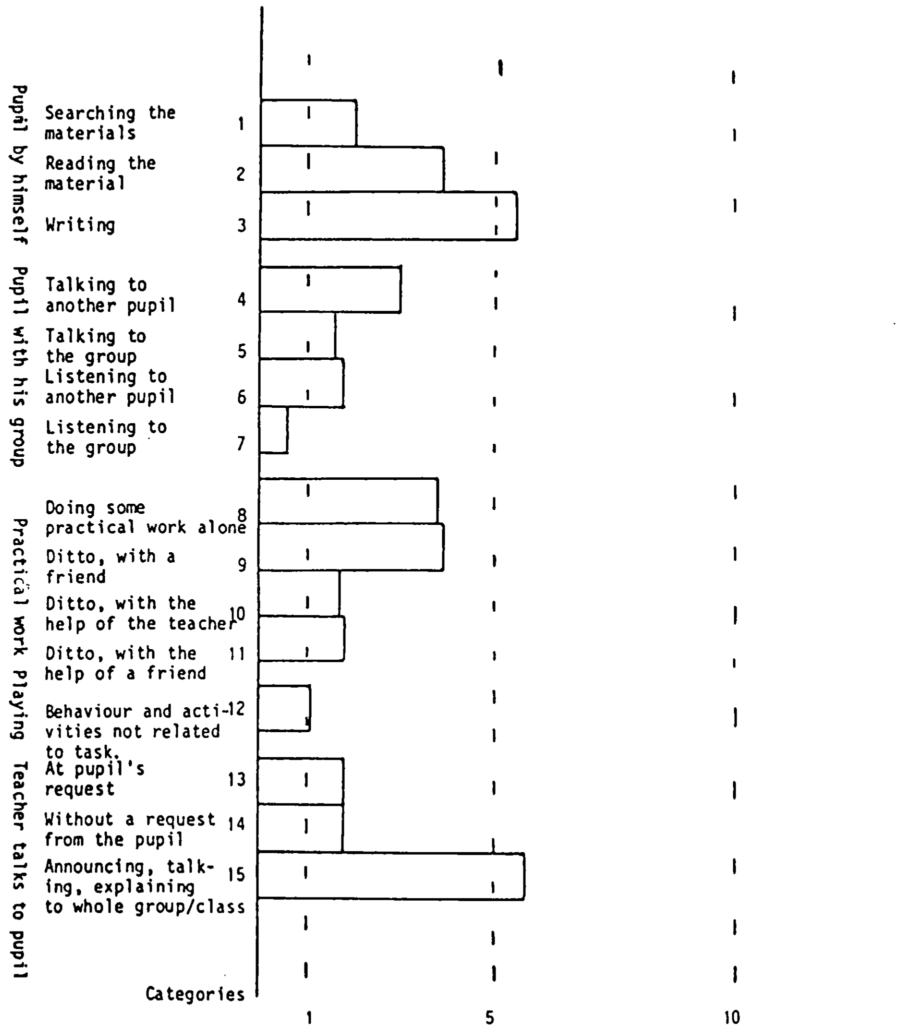


Figure No.16 Mean scores of 25 6th grade pupils in 3 schools
First observation of 40 minutes science lesson

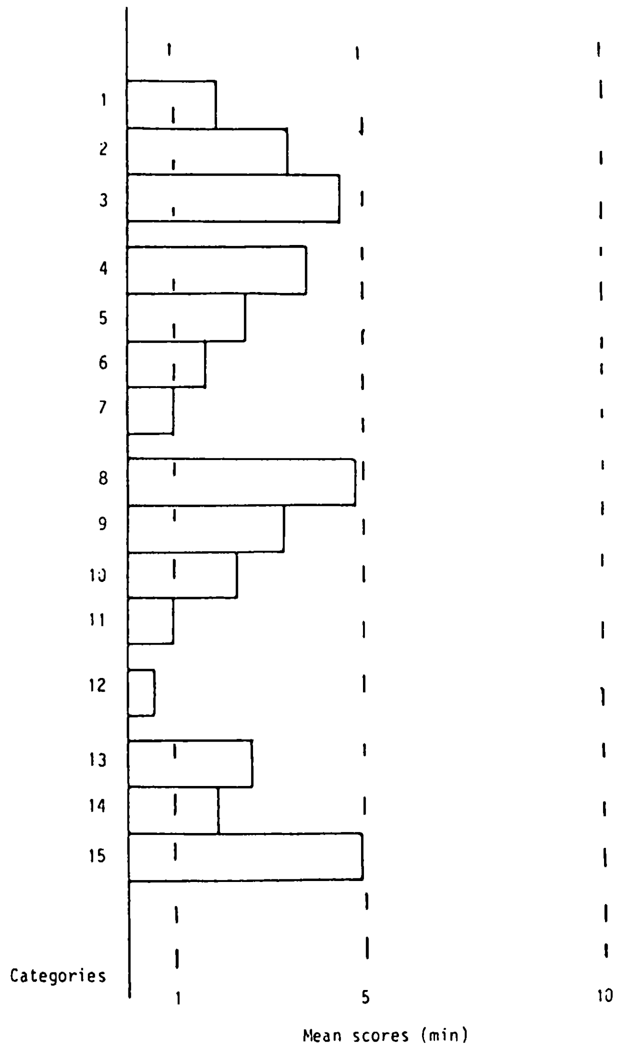


Figure No.17 Mean scores of 25 6th grade pupils in 3 schools
Second observation of 40 minutes science lesson

APPENDIX 25

Other matched pairs

Matched pairs at fifth grade

(a) Mohsen (experimental group)

Mohsen is a pupil in the fifth grade at school No.1 (experimental school).

He is eleven years and two months old. He has a younger sister and brother and two older sisters. His father's education is university level and he works in an office. His mother's education level is middle school, but she is a housewife.

Mohsen had high fever and tonsilitis several times when he was 26 months old, which caused his hearing loss. At the age of seven, he attended the special school for hearing impaired children. He has a hearing loss of 60 dB and an IQ of 113. His communication with his teachers and his group is good. He has problems with language and knowledge in relation to the other pupils in his classroom, because he did not start at the school until he was seven years old and he has never done his homework.

Figures 54 to 57 show the results of the language, mathematics and science pre- and post-tests.

He started to participate with the others in his group and did his homework. This was written on his record card. His behaviour in the classroom during the course was illustrated in the observation check list shown on page 442.

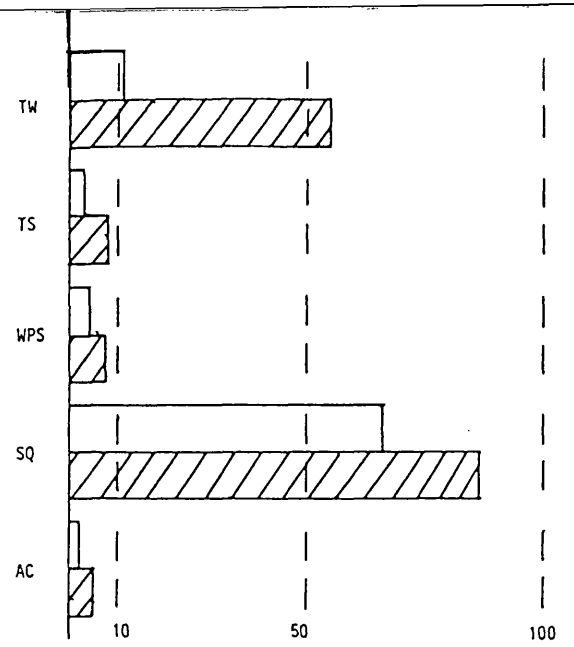


Figure No. 54 Results of the spoken pre- and post-tests

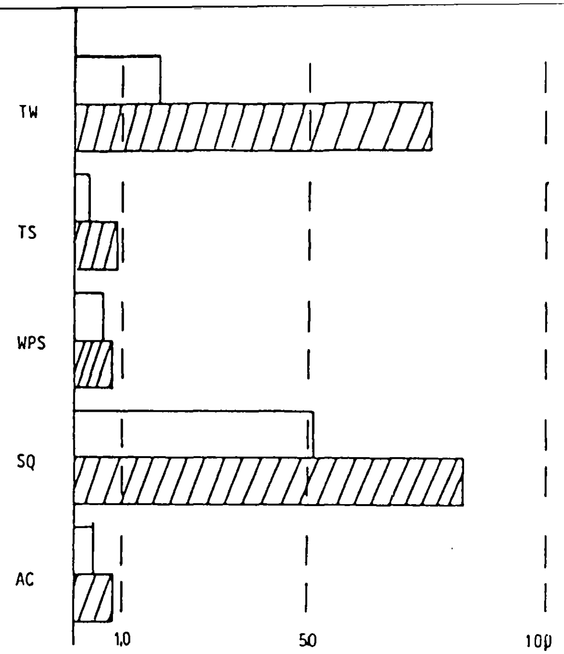


Figure No. 55 Results of the written pre- and post-tests

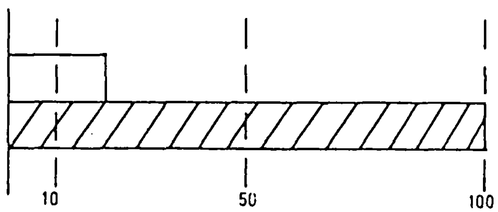


Figure No.56 Results of the mathematics pre- and post- tests

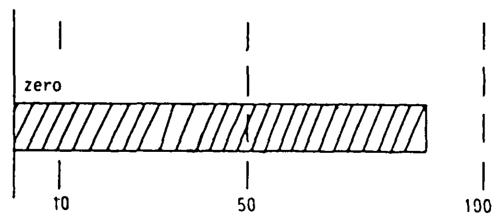


Figure No.57 Results of the science pre- and post-tests

pre-test

post-test

Results of Mohson pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials	2	4
2) reading the materials	2	2
3) writing	2	4
2. The pupil with his/her group		
4) talking to another pupil	2	2
5) talking to the group	2	2
6) listening to another pupil	2	2
7) listening to the group	2	2
3. Practical work		
8) doing some practical work alone	2	6
9) doing some practical work with a friend	6	10
10) doing some practical work with the help of the teacher	2	4
11) doing some practical work with the help of a friend	2	2
4. Playing		
12) behaviour and activities not related to task	0	0
5. Teacher talks to pupils		
13) at pupil's request	2	2
14) without a request from the pupil.	4	2
15) by giving an announcement, talk, explanation to the whole group/class	8	6

Mohsen's observation check list over forty minutes during mathematics and fifty minutes during science.

(b) Hekeem (control group)

Hekeem is one of the pupils in the fifth grade at school No.6 (control school), who is matched with Mohsen. He is ten years and ten months old, has two sisters, one older and one younger than him.

His father's education level is university and he works as a teacher in a secondary school. His mother's education level is primary school and she is a housewife.

Hekeem's hearing impairment was caused by having measles and a high fever at the age of 27 months. He attended this school at the age of six, has a hearing loss of 60 dB and an IQ of 115.

He is a quiet, pleasant boy with a satisfactory level of learning. His communication with his teachers and his group is good (as recorded on his file by his teachers). He copies the lesson and does his homework regularly, as do the other pupils in his group.

The results of his language, mathematics and science pre- and post-tests are shown in Figures 58 to 61.

Hekeem's behaviour during the course of the mathematics and science lessons was noted in the observation check list shown on page 445.

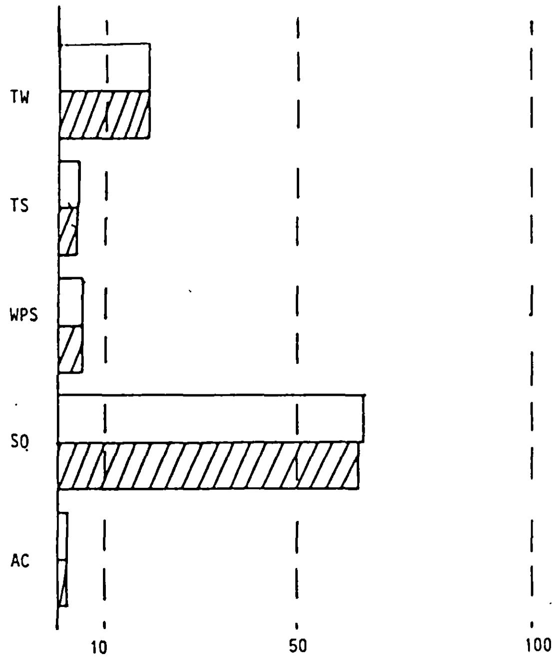


Figure No. 58 Results of the spoken pre- and post-tests

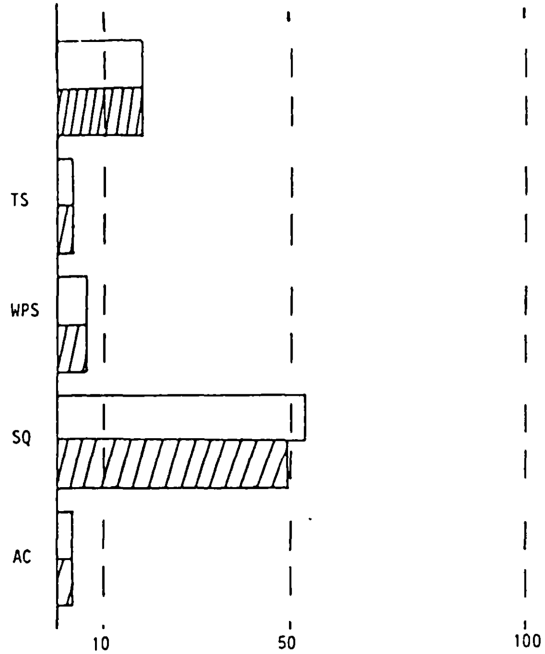


Figure No. 59 Results of the written pre- and post-tests

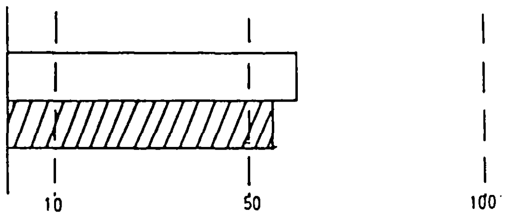


Figure No. 60 Results of the mathematics pre- and post-tests

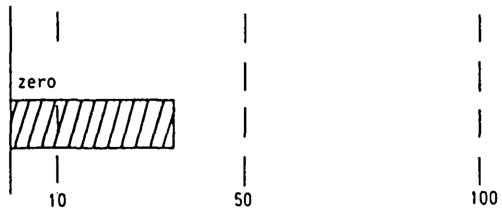
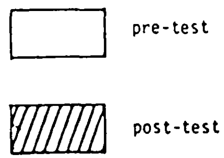


Figure No. 61 Results of the science pre- and post-tests



Results of Hekeem pre- and post-tests

TW = total words
TW = total sentences
WPS = words per sentence
SQ = syntax quotient

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	20	30
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activities not related to task		
5. Teacher talks to pupils		
13) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	20	20

Hakeem's observation check list over forty minutes during mathematics and fifty minutes during science.

Matched pairs at sixth grade

(a) Kesma (experimental school)

Kesma is a pupil in grade six at school No.1 (experimental school). She is twelve years and four months old and is the eldest of three sisters. Her father's education level is secondary school and he works in an office. Her monther's education level is Institute of Primary Teachers and she is a teacher at a primary school.

Kesma's hearing impairment was caused by having measles at 30 months and a high fever several times. She attended this special school at the age of six years and four months. She has a hearing loss of 71 dB and an IQ of 100.

Her report is full of good comments such as: she has normal behaviour, is very tidy and does her homework regularly. But her impairment has affected her language and knowledge.

Kesma's language and knowledge were tested by the pre- and post-test. The results are shown in Figures 62-65.

During the course Kesma started to answer the questions on the work sheets correctly, as noted on her record card. She participated by explaining some lessons in front of the class and worked with her group quite well. She showed progressive improvement lesson by lesson.

During the course, her behaviour in the classroom was observed once in mathematics and once in science (see page 448).

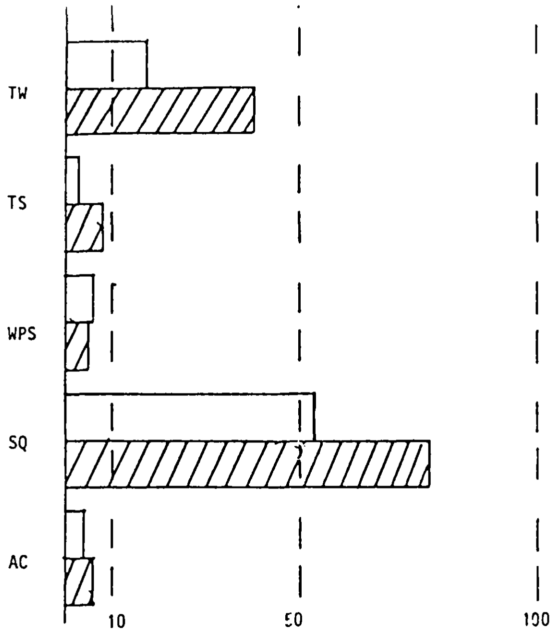


Figure No.62 Results of the spoken pre- and post-tests

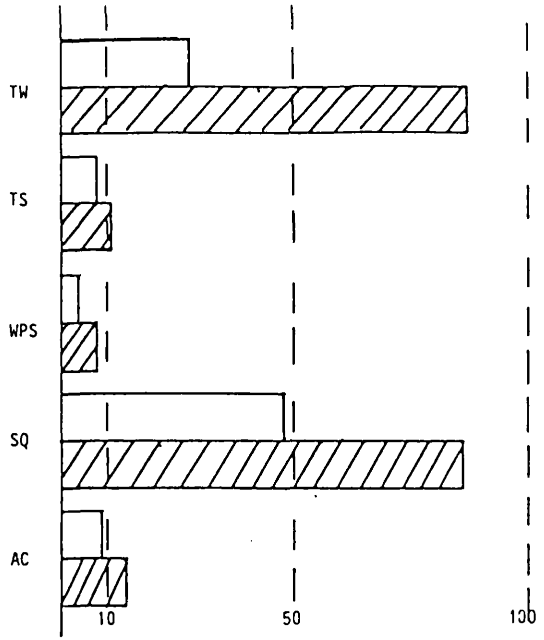


Figure No.63 Results of the written pre- and post-tests

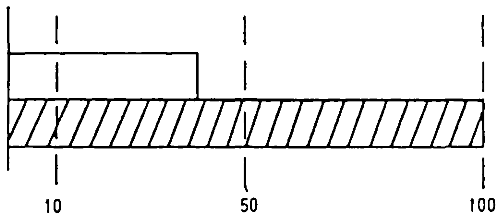


Figure No.64 Results of the mathematics pre- and post-tests

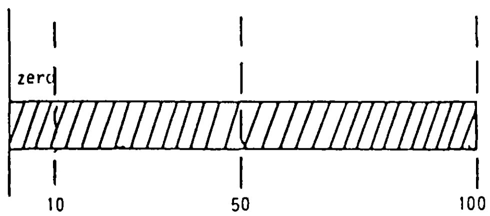
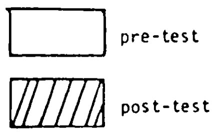


Figure No.65 Results of the science pre- and post-tests



Results of Kesma pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials	2	2
2) reading the materials	6	6
3) writing	4	6
2. The pupil with his/her group		
4) talking to another pupil	4	6
5) talking to the group	2	0
6) listening to another pupil	2	2
7) listening to the group	2	0
3. Practical work		
8) doing some practical work alone	10	0
9) doing some practical work with a friend	0	8
10) doing some practical work with the help of the teacher	2	2
11) doing some practical work with the help of a friend	2	0
4. Playing		
12) behaviour and activities not related to task	2	0
5. Teacher talks to pupils		
13) at pupil's request	4	2
14) without a request from the pupil.	2	2
15) by giving an announcement, talk, explanation to the whole group/class	6	4

Kesma's observation check list over fifty minutes during mathematics and forty minutes during science.

(b) Ahlam (control school)

Ahlam is a pupil in grade six at school No.6 (control school). She is matched with Kesma at school No.6.

She is twelve years and seven months old. She has two elder brothers and two elder sisters, and one younger sister. Her parent's education level is secondary school. Her father works in an office and her mother is a housewife.

When Ahlam was only 32 months old, she had measles with a high fever and cough, which affected her hearing. She has a hearing loss of 71 dB and an IQ of 100.

She is quiet, does her homework regularly and has a good relationship with her teachers and her group. Her language and knowledge were tested with the pre- and post-tests, the results of which are illustrated in Figures 66-69.

Ahlam's behaviour was observed with the same observations check list as before, during the course, once in mathematics and once in science (see page 451).

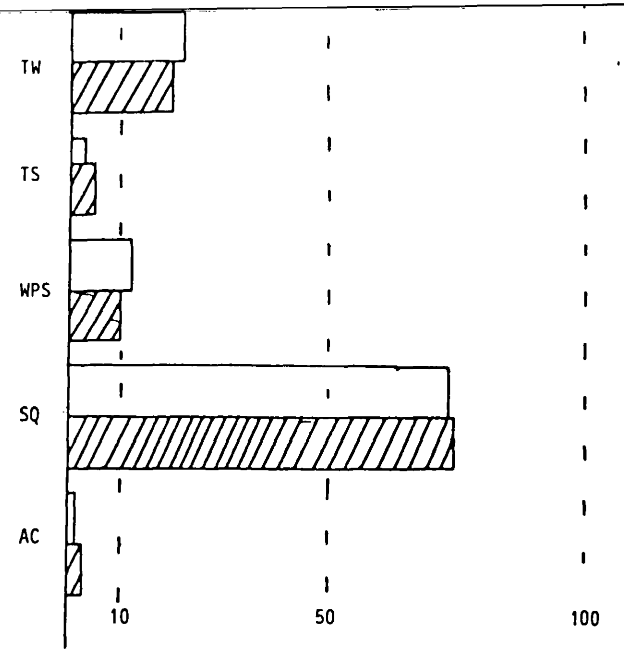


Figure No.66 Results of the spoken language pre- and post-tests

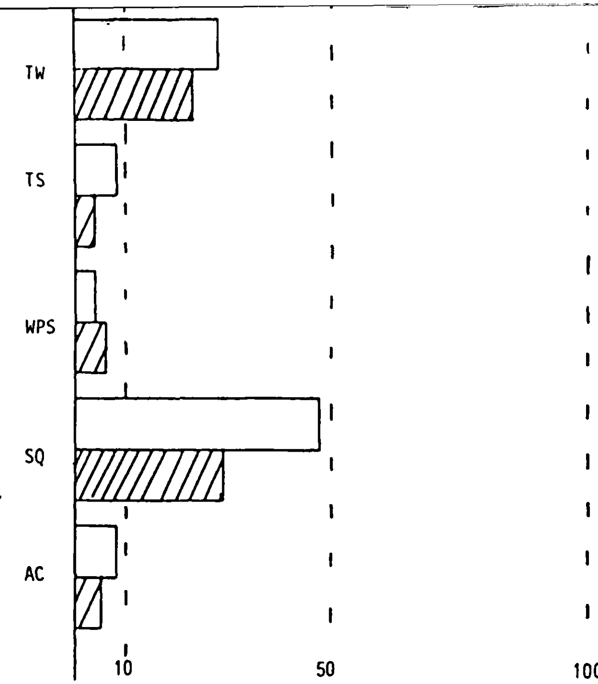


Figure No. 67 Results of the written pre- and post-tests

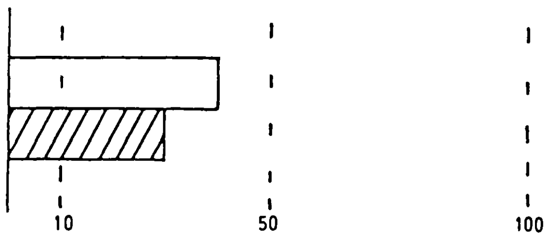


Figure No.68 Results of the mathematics pre- and post tests

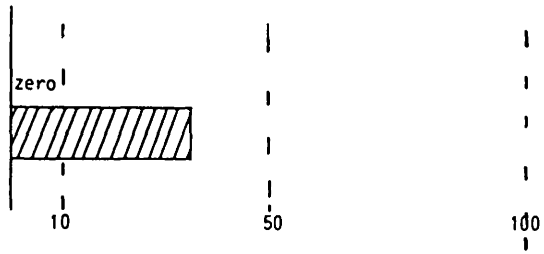
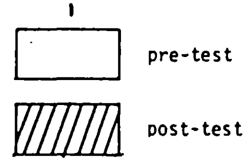


Figure No. 69 Results of the science pre- and post-tests



Results of Ahlam pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	26	20
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activities not related to task		
5. Teacher talks to pupils		
13) at pupil's request	2	
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	22	20

Ahlam's observation check list over fifty minutes during mathematics and forty minutes during science.

(c) Ali (experimental school)

He is one of the pupils in grade six at school No,1 (experimental school).

He is thirteen years old, with two elder sisters, one elder brother and three younger brothers. His father's education level is secondary school and he works in an office. His mother's education level is primary school and she is a housewife.

Ali's hearing impairment was caused by an RH factor and his blood was changed at a very early age.

He attended this school from the age of six. He has a hearing loss of 68 dB and his IQ, as determined by the 'Draw a Man' test was 99. His language was more affected than that of the other pupils, because the onset of his hearing loss was quite early.

The comments in his file are quite interesting. For example, he comes to school every day, has very high activities and is happy. He does not suffer with his hearing impairment and communicates easily with anyone who talks with him. His problem, however, is that he never settles down in the classroom. He comes in the morning, attends the class for five minutes and then disappears. He visits all the classes every day. His teacher suffers from him, since he never copies the lesson and never does his homework - the teacher also comments that he does not even have notebooks.

The boy changed completely when the new methods were applied in his class. He now has notebooks, not only for mathematics and science, but also for other subjects, which makes the teachers happy. He tries to work hard to learn.

He started to answer the questions in the work sheets (as reported on his record card) and discussed them with his teacher (see photograph No.23). In photograph No.24 Ali observes how the other pupils cut the coloured paper before starting to cut his own and reference to photograph No.18 in Neáma's report reveals Ali showing great interest in the science experiment which the teacher performed in front of the class.

His language and knowledge were tested with the pre- and post-tests used before and the results are shown in Figures 70-73.

His behaviour was observed by the investigator once in mathematics and once in science during the course, using the observations check list as before (see page 456).

Photograph No.23

Photograph No.24

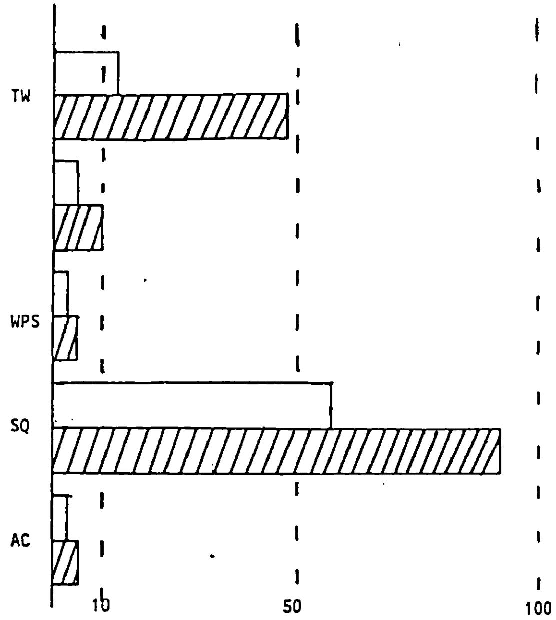


Figure No.70 Results of the spoken language pre- and post-tests

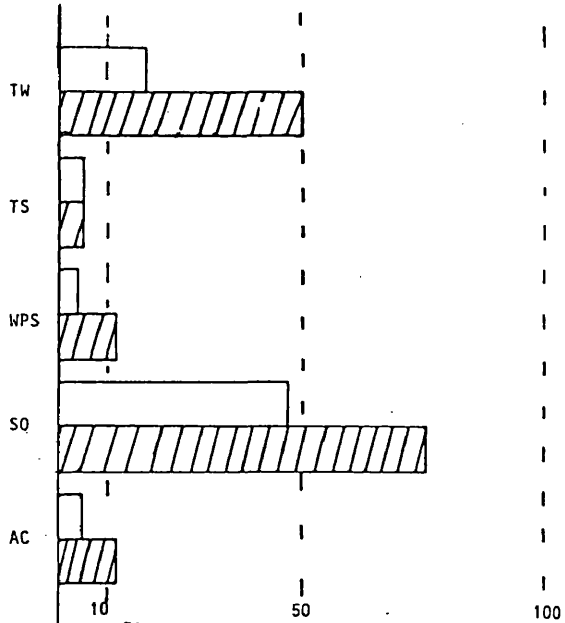


Figure Nq. 71 Results of the written language pre- and post-tests

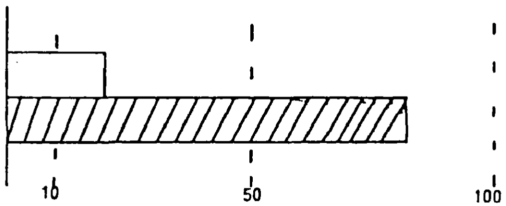


Figure No.72 Results of the mathematic pre- and post-tests

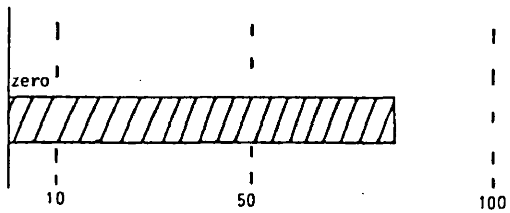
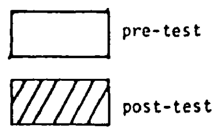


Figure No.73 Results of the science pre- and post-tests



The results of Ali pre- and post-tests

TW = tptal words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

	Behaviour observed	Mathematics	Science
1.	The pupil by him/herself		
	1) searching the materials	2	2
	2) reading the materials	6	8
	3) writing	8	6
2.	The pupil with his/her group		
	4) talking to another pupil	2	4
	5) talking to the group	0	2
	6) listening to another pupil	0	2
	7) listening to the group	0	0
3.	Practical work		
	8) doing some practical work alone	8	6
	9) doing some practical work with a friend	0	0
	10) doing some practical work with the help of the teacher	2	2
	11) doing some practical work with the help of a friend	0	0
4.	Playing		
	12) behaviour and activities not related to task	0	0
5.	Teacher talks to pupils		
	13) at pupil's request	6	4
	14) without a request from the pupil.	2	0
	15) by giving an announcement, talk, explanation to the whole group/class	14	4

Ali's observation check list over fifty minutes during mathematics and forty minutes during science.

(d) Nazer (control group)

Nazer is a pupil in grade six at school No.6 (control school), who was matched with Ali at school No.1 (experimental school).

He is thirteen years and four months old, with two elder brothers and three younger sisters. His father's education level is secondary school and he is self-employed. His mother's educational level is middle school and she is a housewife.

He had whooping cough when he was only 26 months old, which caused his hearing impairment. He has a hearing loss of 68 dB and an IQ of 99.

He attended this special school at the age of six years and four months, but has repeated one year.

Nazer has similar characteristics as Ali, in that some days he does not attend the class, some days he has notebooks whilst on others he does not, with the result that he sometimes copies the lesson and does his homework and at other times not.

He communicates with other pupils in his group, but he is a bit aggressive. His language is satisfactory, when it is remembered that he has attended this school since he was six. He is happy all the time and told me a joke when I visited his school.

Figures 74 to 77 illustrate the results of the pre- and post- tests for language and knowledge.

Nazar's behaviour, as with other pupils, was observed once in mathematics and once in science using the same check list as before, see page 459.

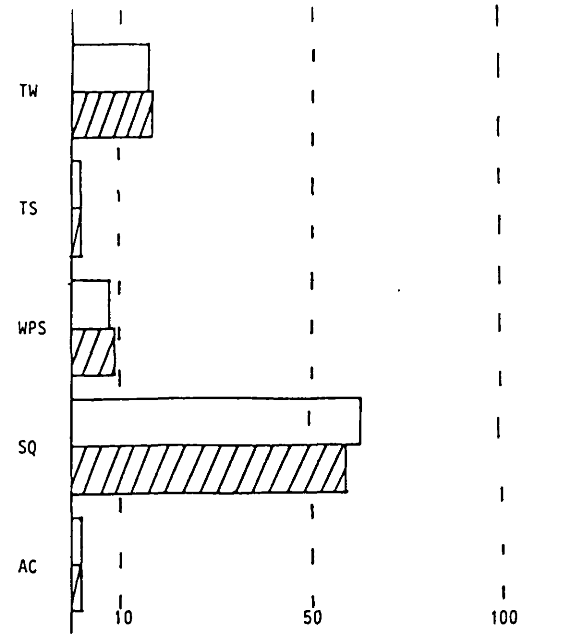


Figure No. 74 Results of the spoken language pre- and post tests

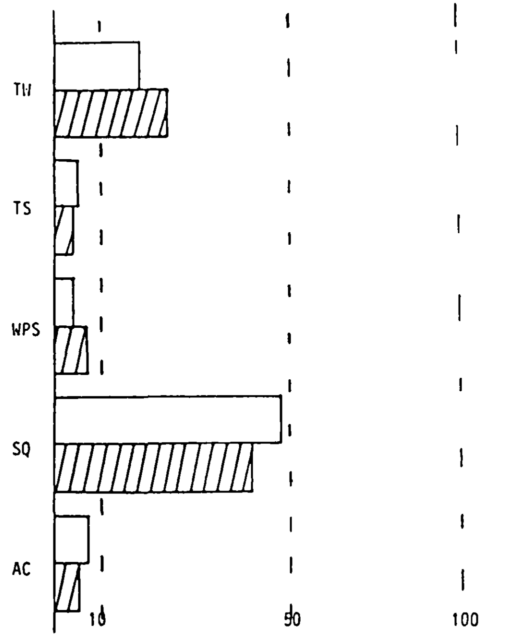


Figure No.75 Results of the written language pre- and post-tests

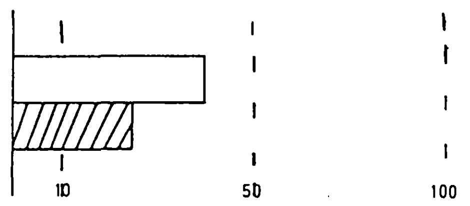


Figure No. 76 Results of the mathematics pre- and post-tests

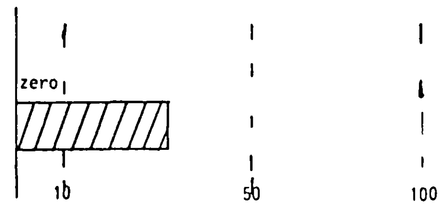
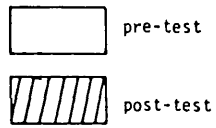


Figure No. 77 Results of the scienct pre- and post-tests



Results of Nazar pre- and post-tests

TW = total words
TW = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	20	20
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activites not related to task	6	4
5. Teacher talks to pupils		
13) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	24	16

Nazar's observation check list over fifty minutes during mathematics and forty minutes during science.

(e) Moafak (experimental group)

Moafak is one of the puils at grade six in school No.3 (experimental school). He is thirteen years old and has only two sisters, being the youngest in the family. His father's education level is middle school and he works as a labourer in a leather factory. His mother is illiterate and she is a housewife.

When Moafak was only 25 months old, he had jaundice, which affected his hearing. He attended this special school at the age of six and has a hearing loss of 67 dB and an IQ of 112, but has repeated one year.

He copies the lessons and does his homework. He communicates with his teacher and his group, but has a problem with the verbal expression of language more than with his writing, and this affects his educational development. He co-operates with others outside the class. He suffers from earache and this causes his hearing aid to bother him at times.

His case improved during the course. He answered the questions right and his writing improved day by day, as reported on his record card. He also expressed himself in language better than before.

The results of the pre- and post-tests of his language and knowledge are shown in Figures 78-81.

During the course, the investigator observed Moafak's behaviour in the classroom, using the same observations check list as before (see page 462).

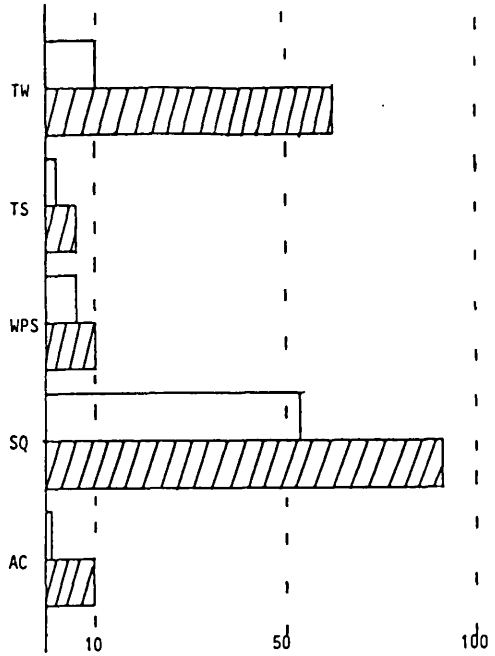


Figure No. 78 Results of the spoken pre- and post-tests

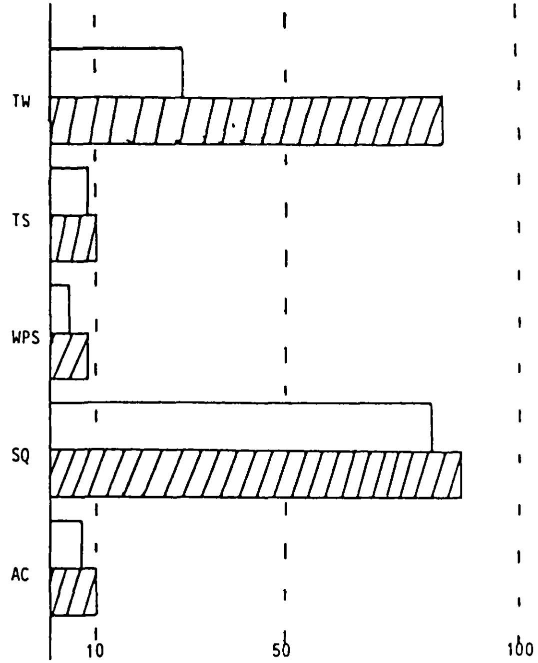


Figure No. 79 Results of the written pre- and post-tests

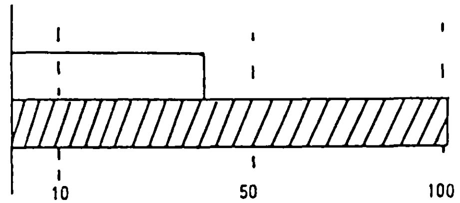


Figure No. 80 The results of the mathematics pre- and post-tests

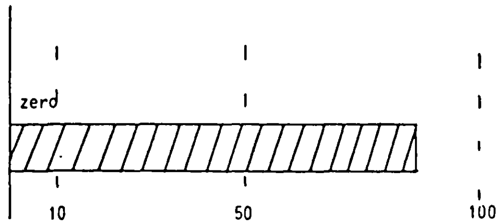
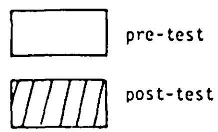


Figure No. 81 The results of the science pre- and post-tests



The results of Moafak pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = anstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials	2	2
2) reading the materials	2	2
3) writing	4	4
2. The pupil with his/her group		
4) talking to another pupil	6	4
5) talking to the group	2	4
6) listening to another pupil	2	2
7) listening to the group	2	0
3. Practical work		
8) doing some practical work alone	8	6
9) doing some practical work with a friend	4	6
10) doing some practical work with the help of the teacher	2	2
11) doing some practical work with the help of a friend	6	0
4. Playing		
12) behaviour and activities not related to task	2	0
5. Teacher talks to pupils		
13) at pupil's request	2	2
14) without a request from the pupil.	2	2
15) by giving an announcement, talk, explanation to the whole group/class	4	4

Moafak's observation check list over fifty minutes during mathematics and forty minutes during science.

(f) Farhan (control school)

Farhan is a pupil in grade six at school No.4 (control school). He was matched with Moafak at school No.3 (experimental school).

He is thirteen years old, with two elder brothers and one younger sister. His father's education level is middle school and he is self-employed. His mother is illiterate and works with her husband.

His hearing impairment was caused by having whooping cough and a high fever at 24 months. He attended the special school at six years of age and has a hearing loss of 67 dB and an IQ of 112, but has repeated one year.

He is happy, participates with others, copies the lessons and does his homework. His language improved year after year. He likes to draw and many of the pictures displayed in the school are his.

His language and knowledge were tested with the pre- and post-tests as before, with the results shown in Figures 82-85.

Farhan's behaviour was observed in the classroom, using the check list as before (see page 464).

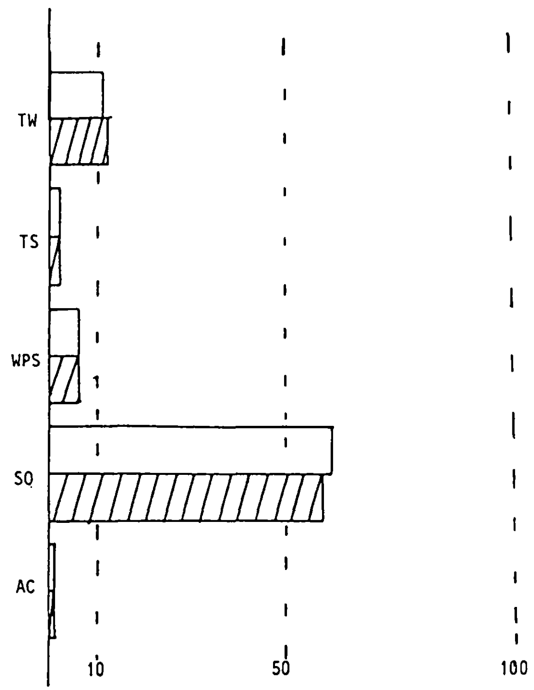


Figure No. 82 Results of the spoken pre- and post-tests

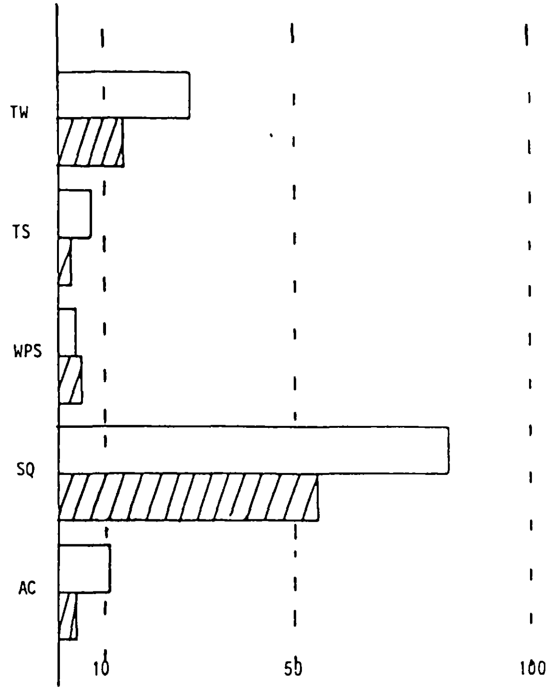


Figure No. 83 Results of the written pre- and post-tests

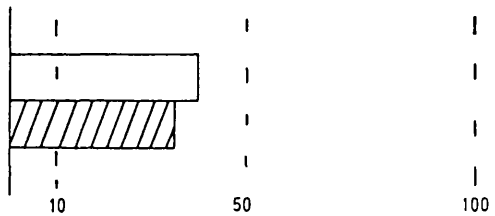


Figure No. 84 Results of the mathematics pre- and post-tests

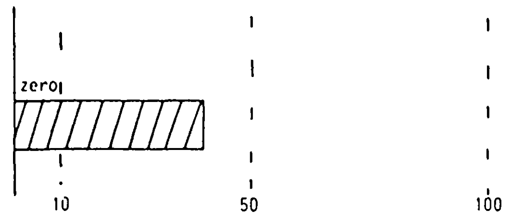
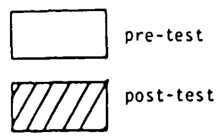


Figure No. 85 Results of the science pre- and post-tests



The result of Farhan pre- and post-tests

TW = total words
TS = total sentences
WPS = words per sentence
SQ = syntax quotient
AC = abstract concrete

Behaviour observed	Mathematics	Science
1. The pupil by him/herself		
1) searching the materials		
2) reading the materials		
3) writing	24	22
2. The pupil with his/her group		
4) talking to another pupil		
5) talking to the group		
6) listening to another pupil		
7) listening to the group		
3. Practical work		
8) doing some practical work alone		
9) doing some practical work with a friend		
10) doing some practical work with the help of the teacher		
11.) doing some practical work with the help of a friend		
4. Playing		
12) behaviour and activities not related to task		
5. Teacher talks to pupils		
13.) at pupil's request		
14) without a request from the pupil.		
15) by giving an announcement, talk, explanation to the whole group/class	26	18

Farhan's observation check list over fifty minutes during mathematics and forty minutes during science.

APPENDIX 26

The following tables illustrate the correlation coefficient between the mathematics post-test and spoken and written post-tests, and science post-test and spoken and written post-tests, by using the Pearson correlation coefficient.

Results of the correlation between post-test written language and post-test mathematics and post-test science

Tests*	POM	POSC
POTW	0.20	0.13
POTS	0.13	-0.02
POWPS	-0.08	-0.02
POSQ	0.31	0.25
POAC	0.01	0.16

Results of the correlation between post-test spoken language and post-test mathematics and post-test science

Tests†	POM	POSC
POSTW	0.06	-0.13
POSTS	0.17	-0.03
POSWPS	-0.14	-0.11
POSSQ	-0.01	-0.11
POSAC	-0.00	-0.03

*Key words:

PMM = post-test mathematics
POSC = post-test science
POTW = post-test written total words
POTS = post-test written total sentence
POWPS = post-test written words per sentence
POAC = post-test written abstract concrete

†Key words:

POM = post-test mathematics
POSC = post-test science
POSTW = post-test spoken total words
POSTS = post-test spoken total sentence
POWPS = post-test spoken words per sentence
POSSQ = post-test spoken syntax quotient
POAC = post-test spoken abstract concrete

APPENDIX 27

THE ANIMALS UNIT MATERIAL

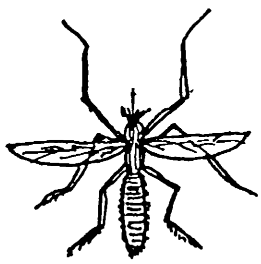
ANIMALS

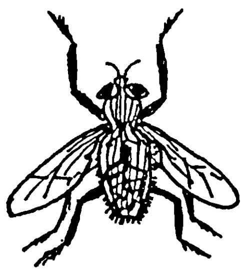
There are two kinds of animals:

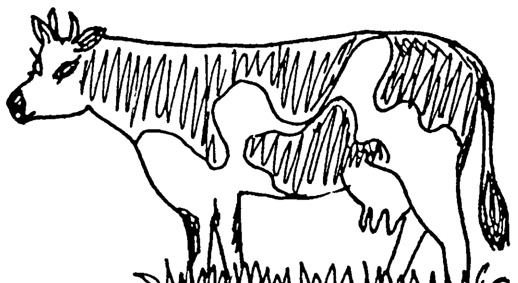
A - Animals which are useful to man (*e.g.*, cow, hen, bee, *etc.*)

B - Animals which are not useful to man (*e.g.*, mouse, fly, mosquito, *etc.*)

- Below are pictures of some animals which are useful, not useful to man.





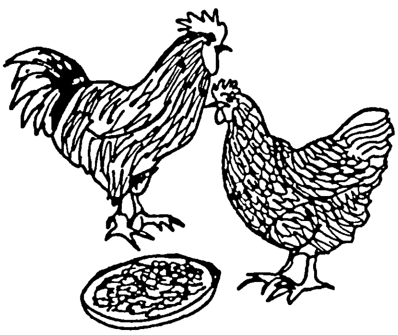


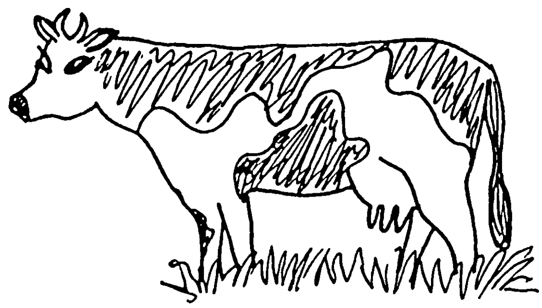
Animals Useful to Man

In order to grow, move, work, think and keep our bodies healthy, we need food. Our food should include many kinds of foodstuffs from animals which are useful (*e.g.*, meat, eggs, milk, cheese and butter).

We can get most of our clothes from animal sources. Animals benefit man in many other ways. For example, dogs are grown (*e.g.*, to guard our houses and to be used in hunting), others are pets, like some birds and goldfish.

1. What kinds of food do you get from the animals below?
2. Are there useful animals in these pictures? What do we benefit from them?
3. What are the names of animals from which we get eggs and meat?

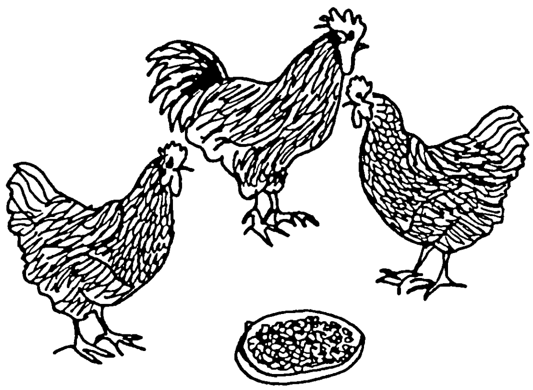




Hen

Hens are one of the animals which man rears for his benefit, using the eggs and the meat as foodstuffs, Man needs these foodstuffs for the construction of a healthy body. We use the feathers to make pillows and mattresses.

1. What useful things do we get from hens? 2, For what things do we use the hen's feathers?

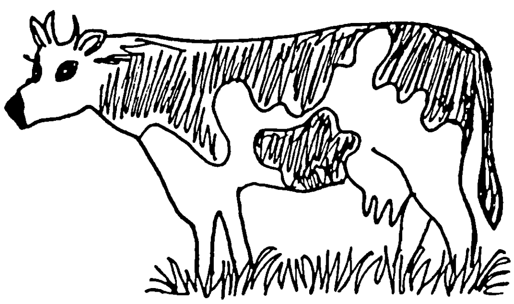


Cow

Cow is a useful animal from which we get meat, milk (yoghurt, cheese, butter and cream) and leather.

The cow is considered as a mammal because she gives birth to babies which are breast fed.

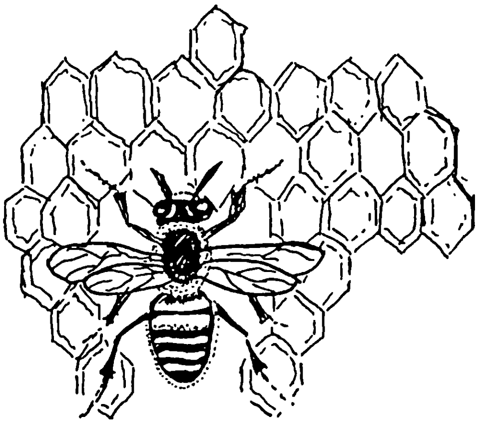
1. From what do we get cheese, butter and yoghurt?
2. What kind of animal is the cow?



Bees

Bees live as communities in wax houses called beehives. Every community consists of bee, queen, number of workers and drones. Bees breed by eggs.

1. Where do bees live?
2. What types of bees are there in a community?
3. What is the benefit of bees?

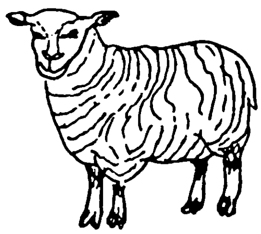


The Advantage of the Useful Animals

Food

As we mentioned before, we need food (to grow, work, move and think). Your food should contain many kinds of food such as meat, eggs, milk, from the animals. However, we get vegetables and fruits from Plants.

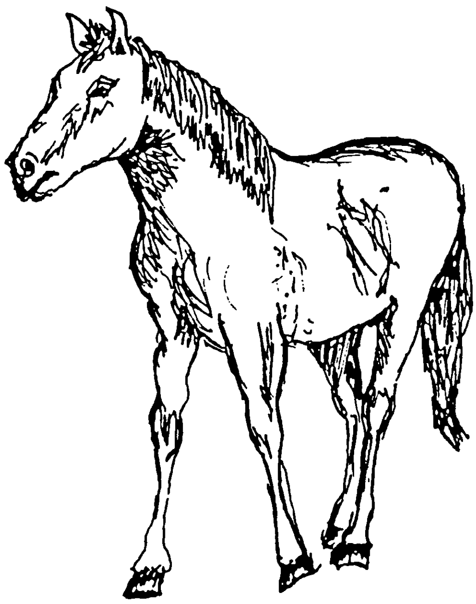
1. What kind of food do we get from the useful animals?
2. What are the names of the animals from which we get eggs?



Fertilisers

From parts of animals not eaten (horn, blood and bones), we get food for our plants called fertiliser. In addition to that, excreta of birds, sheep and cows are used as natural fertiliser.

1. From which animals do we get fertiliser?
2. For what do we use fertiliser?

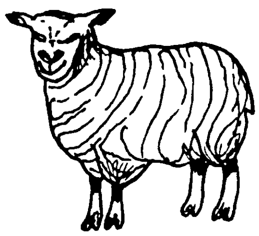


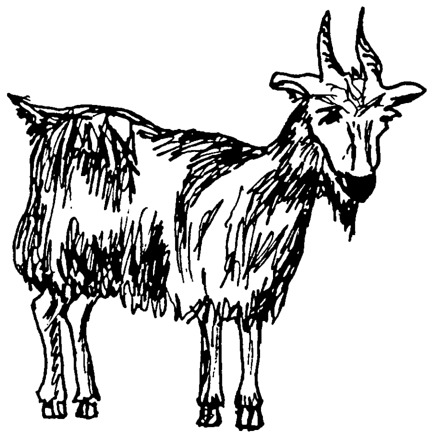
Clothing

We get many of our clothes from animal sources. We need woollen clothes to keep the cold away from us in the winter season.

We need blankets, carpets, most of these things are made from wool. We get wool from sheep. Wool cannot be used in its natural state, except for limited uses. Our shoes are made of the skin of animals after several industrial processes making it softer and brighter and coloured as leather. Leather is usually made from the skins of cows and sheep.

1. From which animals do we get wool?
2. What are the advantages of wool?
3. From which kind of animals do we get leather?
4. What are the advantages of leather?



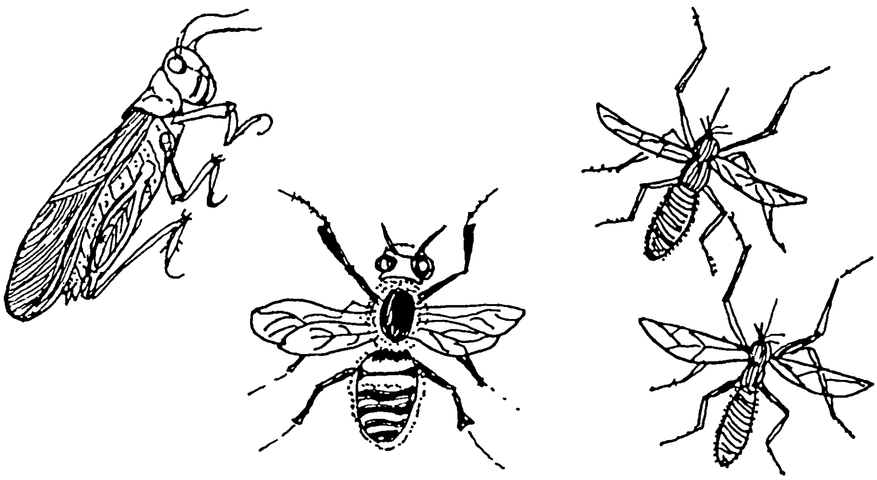


Animals not Useful to Man

There are animals which may live in the house, but hunt man, such as the fly and mosquito. If the house is not kept clean, it will be a suitable place for the life of many harmful insects.

These insects cause many diseases which can cause death to man. There are insects and animals which live on farms which attack the plants, like the locust and the mouse. One of the insects which lives around you and bites you is the mosquito, which can cause typhoid.

1. Which disease is caused by the mosquito?
2. Where do mosquitos and flies live?
3. Are there animals which damage plants? What are these?

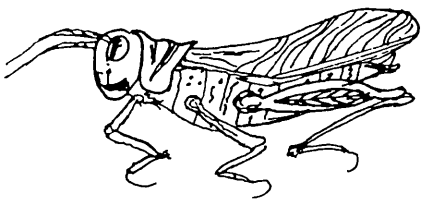


Locusts

It is an insect. Its body divides into three parts: head, chest and stomach. It has three pairs of legs, two pairs of wings. It breeds by eggs. Eggs hatch to insects which cannot fly because they do not have wings. These insects are called pupae. Then they grow and get wings and become like the grown insect.

We can control the locust by insecticides.

1.	Are locusts useful or harmfual insects?
2.	How many parts does the body of the locust consist of?
3.	How do we control locusts?

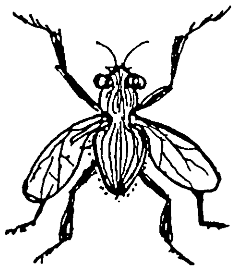


Flies

Flies are one of the harmful insects because their bodies carry the tiniest things present in the places on which they stand.

The body of the fly is covered by very thin hairs, as well as on its legs. These hairs carry germs, which cause illness present in the rubbish and dirt. The fly is one of the human's enemies, because it transfers diseases to him and kills him, such as typhoid and trachoma.

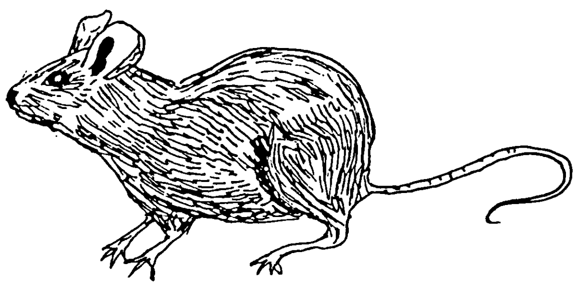
1. Is the fly a useful or harmful insect?
2. What are the diseases which are transferred by the fly?



Mice

One of the animals which hurts man. It has sharp teeth and uses them to bite. It increases quickly and lives where the food is available. If their house is near the place where grain is stored, the mouse harms the grain. If it is near dirty places and rubbish, it transfers the dangerous diseases such as plague.

1. Why are mice considered as harmful animals?
2. Where are their houses?
3. What is the disease which is transferred by mice?



APPENDIX 28

Suggested courses for training teachers of hearing impaired children

The aim is to train teachers to be aware of some aspects of the hearing impaired and how to teach them.

Length of the course:

One academic year.

Courses structure

Two-hour sessions, including lectures, discussion, video-taped material and visits to schools. Assessment by writing some essays, design and practical use of resource-based active learning (as outlined in this thesis), and examinations.

Content should include:

1. Child development including:
   - Language development in relation to mental growth.
   - Social and emotional development.
   - Learning.
   - Physical growth.
2. Audiology (in relation to education) including:
   - Elementary physics of sound, physics of speech and hearing.
   - Measurement of hearing.
   - Design, performance and use of hearing aids, audiometers and sound level meters.
   - Causes of deafness.

3. Speech and auditory training including:
   - The development and function of speech as a means of communication.
   - The development in hearing impaired children of the capacity to understand speech and talk.
   - methods of teaching speech to hearing impaired children.

4. Curriculum and methods of teaching:
   - Curricula in schools with particular reference to the needs of pupils at different stages.
   - The teaching of each subject.
   - The use of visual aids in schools for the hearing impaired.
   - The use of resource-based learning and active learning methods (as outlined in this thesis).

5. Educational provision with special reference to hearing impaired children

6. Practical work in teaching:
   - School visits (ordinary and special).
   - Practical work in the special schools of hearing impaired children.
   - Designing and using resource-based active learning methods.

APPENDIX A

Scores for Mathematics and science Tests for the three Grades.

- Reliability Cofficients -

"Mathematics test, Fourth Grade

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN PEOPLE	3757.30909	43	87.37928		
WITHIN PEOPLE	16731.86667	616	27.16212		
BETWEEN MEASURES	5412.81212	14	386.62944	20.56275	0.00000
RESIDUAL	11319.05455	602	18.80242		
NONADDITIVITY	3098.51344	1	3098.51344	226.53090	0.00000
BALANCE	8220.54110	601	13.67810		
TOTAL	20489.17576	659	31.09131		

GRAND MEAN = 4.59394

TUKEY ESTIMATE OF POWER TO WHICH OBSERVATIONS MUST BE RAISED TO ACHIEVE ADDITIVITY = -0.4567465

HOTELLINGS T-SQUARED = 1303.08071 F = 64.93758
DEGREES OF FREEDOM * * NUMERATOR = 14 DENOMINATOR= 30 PROBABILITY = 0.00000

RELIABILITY COEFFICIENTS 15 ITEMS

ALPHA = 0.78482 STANDARDIZED ITEM ALPHA = 0.83100

Mathematics test , Fifth Grade

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN PEOPLE	2411.37500	31	77.78629		
WITHIN PEOPLE	6890.61538	384	17.94431		
BETWEEN MEASURES	3405.42788	12	283.78566	30.29056	0.00000
RESIDUAL	3485.18750	372	9.36878		
NONADDITIVITY	541.28796	1	541.28796	68.21491	0.00000
BALANCE	2943.89954	371	7.93504		
TOTAL	9301.99038	415	22.41443		

GRAND MEAN = 5.49519

TUKEY ESTIMATE OF POWER TO WHICH OBSERVATIONS MUST BE RAISED TO ACHIEVE ADDITIVITY = 0.0900333

HOTELLING'S T SQUARED CANNOT BE COMPUTED BECAUSE OF A SINGULAR MATRIX

RELIABILITY COEFFICIENTS 13 ITEMS

ALPHA = 0.87956 STANDARDIZED ITEM ALPHA = 0.87651

Mathematics, Sixth Grade.

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN PEOPLE	3724.66667	49	76.01361		
WITHIN PEOPLE	8237.16667	550	14.97667		
BETWEEN MEASURES	3221.55333	11	292.86848	31.47294	0.00000
RESIDUAL	5015.61333	539	9.30541		
NONADDITIVITY	551.64772	1	551.64772	66.48494	0.00000
BALANCE	4463.96562	538	8.29733		
TOTAL	11961.83333	599	19.96967		

GRAND MEAN = 5.38333

TUKEY ESTIMATE OF POWER TO WHICH OBSERVATIONS MUST BE RAISED TO ACHIEVE ADDITIVITY = 0.1059096

HOTELLING'S T SQUARED CANNOT BE COMPUTED BECAUSE OF A SINGULAR MATRIX

RELIABILITY COEFFICIENTS 12 ITEMS

ALPHA = 0.87758 STANDARDIZED ITEM ALPHA = 0.89447

Science Test, Sixth Grade

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN PEOPLE	2352.58526	49	48.01194		
WITHIN PEOPLE	8835.47368	900	9.81719		
BETWEEN MEASURES	4106.33895	18	228.12994	42.54702	0.00000
RESIDUAL	4729.13474	882	5.36183		
NONADDITIVITY	1018.00697	1	1018.00697	241.66889	0.00000
BALANCE	3711.12777	881	4.21240		
TOTAL	11188.05895	949	11.78931		

GRAND MEAN = 3.46105

TUKEY ESTIMATE OF POWER TO WHICH OBSERVATIONS MUST BE RAISED TO ACHIEVE ADDITIVITY = -0.0950786

HOTELLINGS T-SQUARED = 1138.41198 F = 41.30293
DEGREES OF FREEDOM * * NUMERATOR = 18 DENOMINATOR= 32 PROBABILITY = 0.00000

RELIABILITY COEFFICIENTS 19 ITEMS

ALPHA = 0.88032 STANDARDIZED ITEM ALPHA = 0.88257

Science Test , Fourth and Fifth Grades

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN PEOPLE	3403.68421	75	45.38246		
WITHIN PEOPLE	14229.63043	1672	8.51054		
BETWEEN MEASURES	7716.53833	22	350.75174	88.85801	0.00000
RESIDUAL	6513.09211	1650	3.94733		
NONADDITIVITY	978.65239	1	978.65239	291.59190	0.00000
BALANCE	5534.43972	1649	3.35624		
TOTAL	17633.31465	1747	10.09348		

GRAND MEAN = 2.85812

TUKEY ESTIMATE OF POWER TO WHICH OBSERVATIONS MUST BE RAISED TO ACHIEVE ADDITIVITY = 0.2705760

HOTELLINGS T-SQUARED = 7506.49007 F = 245.60695

DEGREES OF FREEDOM * * NUMERATOR = 22 DENOMINATOR= 54 PROBABILITY = 0.00000

RELIABILITY COEFFICIENTS 23 ITEMS

ALPHA = 0.91592 STANDARDIZED ITEM ALPHA = 0.95329

APPENDIX B.

MANN - WHITNEY U test Results

For: pre and post Language 'Written and Spoken' and attainment tests, 'Mathematics and Science'.

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRTW (pre test written language total words)
BY GROUP

Experimental		Control	
GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
63.48	63	63.52	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1983.0	3999.0	-0.0073	0.9942

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRTS (pre test written language total sentence)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
62.63	63	64.37	63

CORRECTED FOR TIES

U	W	Z	2-TAILED P
1930.0	3946.0	-0.2691	0.7879

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRWPS (pre test written test words per sentence)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
65.01	63	61.99	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1889.5	4095.5	-0.4753	0.6346

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRSQ (pre test written language syntax quotient)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
64.90	63	62.10	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1896.0	4089.0	-0.4322	0.6656

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRAL (pre test written language abstract concrete)
BY GROUP

5

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
63.68	63	63.32	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1973.0	4012.0	-0.0567	0.9548

6

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRSTW (pre test spoken language total words)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
59.87	63	67.13	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1756.0	3772.0	-1.1180	0.2636

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PRSTS (pre test spoken language total sentences)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
66.24	63	60.76	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1812.0	4173.0	-0.8553	0.3924

8

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

FRSWPS (pre test spoken language words per sentence)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
56.62	63	70.38	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1551.0	3567.0	-2.1421	0.0322

```
PRE AND POST TEST.

FILE    NADIA.    (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

    PRSSQ    (pre test spoken language syntax quotient)
 BY GROUP

     GROUP      =           1      GROUP      =          2
     MEAN RANK         NUMBER      MEAN RANK        NUMBER
         62.94             63          64.06            63

                                   CORRECTED FOR TIES
         U                 W            Z       2-TAILED P
      1949.0          3965.0      -0.1733          0.8624
```

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PRE AND POST TEST.

FILE   NADIA.   (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

   PRSAC   (pre test Spoken Language abstract Concrete)
 BY GROUP

     GROUP     =           1     GROUP     =           2
     MEAN RANK        NUMBER     MEAN RANK        NUMBER
         58.36            63         68.64            63

                                   CORRECTED FOR TIES
          U              W             Z      2-TAILED P
       1060.5         3076.5       -1.6980        0.0895
```

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- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

PRE AND POST TEST.

FILE    NADIA.    (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

    PRM
  BY GROUP

      GROUP    =               1         GROUP    =             2
      MEAN RANK          NUMBER          MEAN RANK         NUMBER
          55.00              63              72.00             63

                                            CORRECTED FOR TIES
            U                 W                 Z        2-TAILED P
         1449.0            3465.0          -2.8789        0.0040
```

Pre test Mathematics

//

```
PRE AND POST TEST.

FILE    NADIA.    (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

    PRSC   (pre test Science)
 BY GROUP

      GROUP      =          1     GROUP      =          2
      MEAN RANK        NUMBER     MEAN RANK        NUMBER
         63.50             63        63.50             63

                                      CORRECTED FOR TIES
          U                W             Z      2-TAILED P
       1984.5         4000.5        0.0000          1.0000
```

```
PRE AND POST TEST.

FILE    NADIA.    (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

    PUTW    (Post test written language total words)
  BY GROUP

      GROUP    =          1     GROUP    =          2
      MEAN RANK      NUMBER     MEAN RANK      NUMBER
          95.00          63         32.00          63

                                    CORRECTED FOR TIES
          U              W              Z   2-TAILED P
        0.0         5985.0        -9.6869       0.0000
```

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PUTS (post test written Language total Sentences)
BY GROUP

GROUP = 1		GROUP = 2	
MEAN RANK	NUMBER	MEAN RANK	NUMBER
89.04	63	37.96	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
375.5	5609.5	-7.8978	0.0000

15

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PUWPS (post test written language words per sentence)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
91.81	63	35.19	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
201.0	5784.0	-8.7544	0.0000

```
PRE AND POST TEST.

FILE   NADIA.   (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

    POSQ      (post test written language syntax
 BY GROUP                                   quotient)

     GROUP      =          1     GROUP      =          2
     MEAN RANK        NUMBER     MEAN RANK        NUMBER
         93.98            63         33.02            63

                                 CORRECTED FOR TIES
          U             W             Z       2-TAILED P
        64.5        5920.5       -9.3726        0.0000
```

17

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PUAC (post test written language abstract concrete)
BY GROUP

GROUP = 1		GROUP = 2	
MEAN RANK	NUMBER	MEAN RANK	NUMBER
92.27	63	34.73	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
172.0	5815.0	-8.8775	0.0000

18

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

POSTW (post test spoken language total words)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
93.76	63	33.24	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
78.0	5907.0	-9.3061	0.0000

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

POSTS (post test spoken language total sentences)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
92.75	63	34.25	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
141.5	5843.5	-9.0378	0.0000

19

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85) 20

- - - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

POSWPS (post test spoken language words per sentence)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
62.48	63	64.52	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
1920.0	3936.0	-0.3195	0.7493

21

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

POSSQ (post test spoken language syntax quotient)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
93.40	63	33.60	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
100.5	5884.5	-9.1956	0.0000

22

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

PUSAC (post test spoken language abstract concrete)
BY GROUP

GROUP =	1	GROUP =	2
MEAN RANK	NUMBER	MEAN RANK	NUMBER
93.56	63	33.44	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
91.0	5894.0	-9.3351	0.0000

23

```
PRE AND POST TEST.

FILE   NADIA.   (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

     PUM     (post test  Mathematics)
   BY GROUP

        GROUP      =              1       GROUP      =              2
        MEAN RANK           NUMBER        MEAN RANK           NUMBER
            95.00               63            32.00               63

                                              CORRECTED FOR TIES
             U                   W               Z          2-TAILED P
             0.0            5985.0         -9.8282           0.0000
```

PRE AND POST TEST.

FILE NADIA. (CREATION DATE = 26/02/85)

- - - - - MANN-WHITNEY U - WILCOXON RANK SUM W TEST

POSC (post test science)
BY GROUP

GROUP = 1		GROUP = 2	
MEAN RANK	NUMBER	MEAN RANK	NUMBER
95.00	63	32.00	63

		CORRECTED FOR TIES	
U	W	Z	2-TAILED P
0.0	5985.0	-9.7494	0.0000